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ABSTRACT

This handbook enables teachers to proceed from understanding to practical incorporation in the classroom of "Common Essential Learnings," an appropriate and sound pedagogy, based on techniques of questioning, reflection, and dialogue. The "Common Essential Learnings" comprise six categories: (1) communication, which focuses on improving students' understanding of language demands; (2) numeracy, which is concerned with developing students' knowledge, skills, and appreciations of mathematical ideas, techniques, and applications; (3) critical and creative thinking, which is intended to develop students' abilities to create and evaluate ideas, processes, experiences, and objects; (4) technological literacy, which is concerned with improving students' understandings of how technological systems are integral parts of social systems; (5) personal and social values and skills, which include the personal, moral, social, and cultural aspects of each school subject and of the school environment; and (6) independent learning, which focuses on creation of opportunities and experiences necessary for students to become capable, self-reliant, self-motivated, and life-long learners. (LL)

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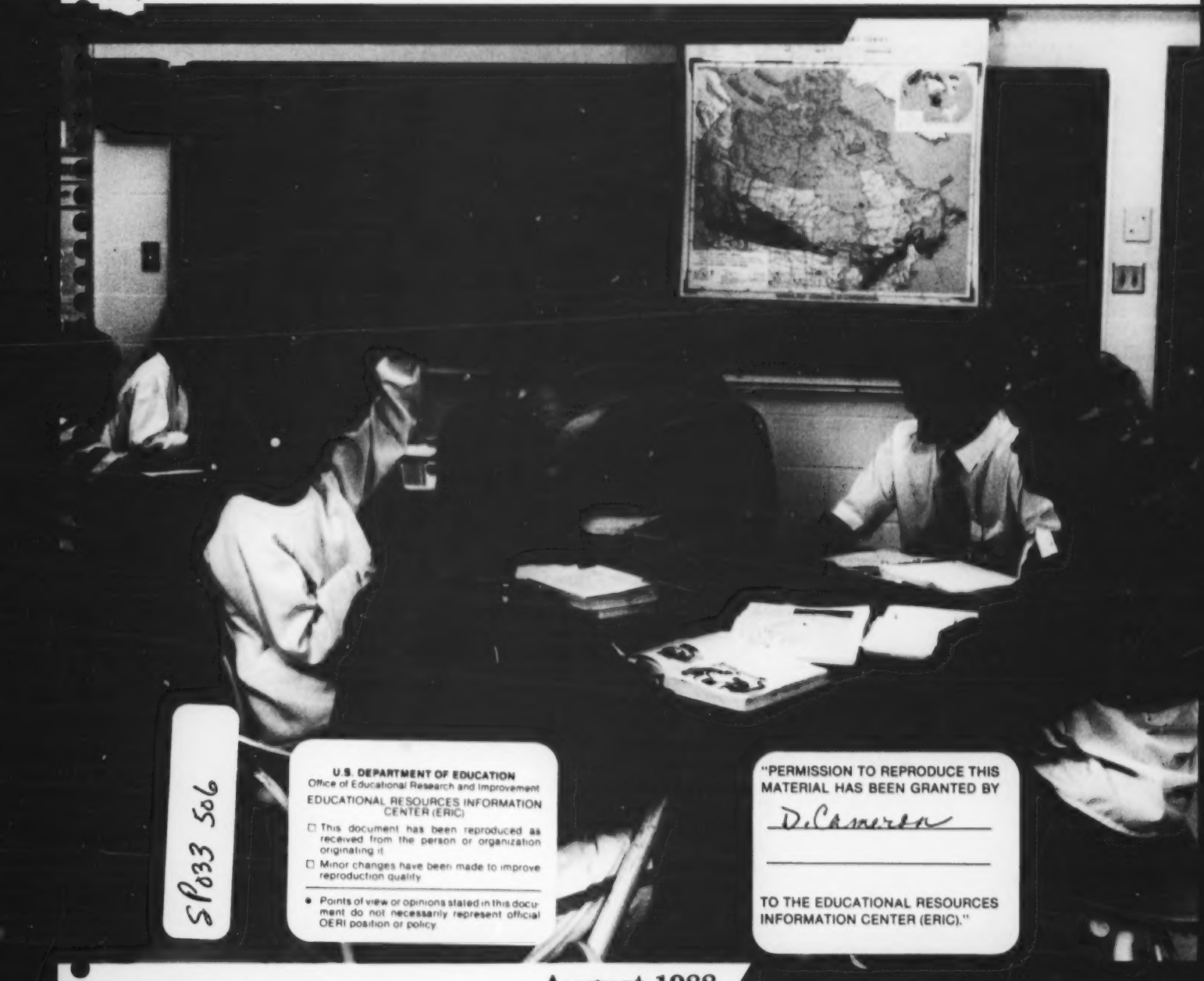
Understanding the Common Essential Learnings

A Handbook for Teachers



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Understanding the Common Essential Learnings

A Handbook for Teachers

Saskatchewan Education
August 1988

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who participated in the March 1988 conference in Saskatoon which focussed upon an analysis of this handbook in relation to instruction.

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Preface

The Common Essential Learnings (C.E.L.s) are a set of six interrelated areas containing understandings, values, skills and processes which are considered important as foundations for learning in all school subjects. They represent a further translation of Saskatchewan's Goals of Education (1984) into a more specific outline of the kinds of teaching practices that are needed and the kinds of understandings which we wish to develop in our students. The Common Essential Learnings together with the Required Areas of Study provide descriptions of what we believe is meant by a good education, as well as descriptions of the purposes of education and the means to achieve these purposes. That is, each Common Essential Learning as developed through the Required Areas of Study is an attempt to answer such important questions as: **What** do we believe is most important for students to learn?; **Why** do we believe these understandings to be important?; and **How** might we achieve these important ends? The Common Essential Learnings do not represent final or complete answers to these questions.

Education, at its best, is a dynamic process involving individuals and groups in reflecting upon their lives and the society in which they live. It is a process shaped by the past, by persons' goals for the future and by the nature of their present contexts. This means education is a living process which must be refined by the understandings of those involved and by the changing demands of the present.

Saskatchewan Education, in defining its Core Curriculum as both Required Areas of Study and Common Essential Learnings, wishes to move closer to offering all students an education of worth. Understanding the unique and the universal nature of human learning requires a curriculum framework which responds to both. As the two pieces of writing which follow remind us, our students invest their time and abilities, their hopes and their dreams into the education which we provide.

School

I really like school but I would like school better if I was smarter than I am now. I think I'm dumb and so does every one else think I am dumb.

P.S.
Norman

Journal Entry

It seems to me that the smartest people break the rules. A seemingly irrational thought hits them and they make a significant discovery or theory. Wanting to become a scientist, I suppose most of the examples I can cite are related to science. Charles Darwin is a good example. Lyell's work in Geology and Malthus' work in populations along with his own observations in the Galapagos triggered Darwin to postulate his theory of evolution.

Here I am, currently an undergraduate doing well in my courses having won scholarships in high school and university. However I'm worried. I'm taking all the "relevant" classes to obtain my honors degree, but it seems too restricted. I feel like I'm being channelled. If I am a good little student and keep following the system I'm afraid any sparks of imagination will be lost. The best scientists seem ironically not to follow the system. They get insights very often from outside the traditional scientific world.

I am also afraid that I will lose touch with the Arts. I spent my first year at university taking Arts classes. It has been one of the biggest things giving me an advantage over my current fellow students. But if I continue down the scientific path am I going to lose my touch with poetry, languages, art, and music?

I wish straight from Day One I was able to get a Renaissance education. Although the world is becoming highly polarized and specialized I feel that to make a significant contribution I somehow have to become a "Renaissance woman".

As teachers we are constantly challenged to meet aspirations such as these with a vision that encompasses both our students' unique qualities and their common humanity. The feelings expressed by these two students remind us that this vision cannot be narrow and cannot be final.

The more we reflect upon the potential of education to create a better tomorrow, the more we understand that our students' failures are our failure, their successes our success.

Chapter I: From Understanding to Action

Purpose of the Handbook

Saskatchewan Education developed *Understanding the Common Essential Learnings* as a support for teachers in the incorporation of the Common Essential Learnings into their teaching. It is a foundational document intended to support further questioning, reflection and dialogue. The purpose of the handbook is to provide teachers with an overview of each Common Essential Learning as it relates to teaching practice. It is hoped that the material provided will be useful in helping educators examine the scope and the purpose of each Common Essential Learning as they begin incorporating them into instruction. However, *Understanding the Common Essential Learnings* is not intended as a detailed "how-to-do-it" manual. It is a starting point in the process of incorporating the Common Essential Learnings into instruction. The Common Essential Learnings will receive more detailed treatment as new curricula in the Required Areas of Study are implemented.

Saskatchewan Education recognizes that the ideas expressed here are not necessarily new, and that many of the suggestions for appropriate and sound instructional methods represent current practice. It is hoped that the conscious articulation of the C.E.L.s developed through this handbook can further guide educators' observations, thoughts and actions.

Definition of the Individual Common Essential Learnings

The Common Essential Learnings comprise six categories: Communication, Numeracy, Critical and Creative Thinking, Technological Literacy, Personal and Social Values and Skills, and Independent Learning.

Communication focuses on improving students' understanding of the language demands in each of the Required Areas of Study, based on a recognition that language is central to learning in all subject areas. Communication does not require that all teachers become language arts teachers, but rather, that teachers understand the role played by language in their subject area(s) and deal systematically and concretely with that role in their instructional methods. The goal is to promote students' learning in all school subjects through improving their language abilities within each subject.

Numeracy is concerned with developing students' knowledge, skills and appreciations of mathematical ideas, techniques and applications. In relation to instruction, Numeracy suggests that a better balance is required between knowing **how** to compute, measure, estimate and interpret mathematical data, knowing **when** to apply these same skills and techniques and understanding **why** these particular processes apply. The goal is to enable students to cope confidently and competently with everyday situations demanding the use of mathematical concepts, as well as developing their ability to learn new concepts when necessary. Further, Numeracy is intended to strengthen students' learning in all school subjects through providing them with grounded understanding of the quantitative aspects of each subject.

Critical and Creative Thinking is intended to better develop students' abilities to create and to evaluate ideas, processes, experiences and objects. It requires that teachers and students learn to articulate, publicly defend, and change when necessary, their criteria for evaluation. The goal is to develop students who value knowledge, learning and the creative process, who can and will think for themselves, yet recognize the limits of individual reflection and the need to contribute to and build upon mutual understandings of social situations.

Technological Literacy is concerned with improving students' understanding of how technological systems are integral parts of social systems, and that they cannot be fully separated from the political, cultural and economic frameworks which shape them. The goal is to have students appreciate the value of technology in society within the context of its limitations, and see themselves as having roles and responsibilities in shaping public policy related to technological change.

Personal and Social Values and Skills examines the personal, moral, social and cultural aspects of each school subject and of the school environment. It reflects a concern with the development of responsible and compassionate individuals and with developing understanding of

the rational basis for moral claims. What is desired are students who are capable of self reliance and willing and able to work harmoniously in groups and with other groups. Increased understanding of how culture shapes our thoughts and values is also an important goal of this C.E.L.

Independent Learning focuses on creation of the opportunities and experiences necessary for students to become capable, self-reliant, self-motivated and life-long learners. What is desired are students who value learning as an empowering activity of great personal and social worth. All of the other C.E.L.s contribute to the goal of developing independent learners.

Incorporating the Common Essential Learnings into Instruction: Scope and Limitations

Before proceeding with further examination of the Common Essential Learnings, it is important to be clear about **how** the C.E.L.s will shape curricula and instruction in Saskatchewan. Several understandings are important to note here:

1. **The Common Essential Learnings are not new school subjects and therefore are not substitutes for content in the Required Areas of Study.**
2. **Students will not be evaluated on their acquisition of the C.E.L.s independently of school subject matter.**
3. **The Common Essential Learnings are not mutually exclusive areas. They overlap and are interrelated in important ways.**
4. **This handbook is developed as part of the awareness stage of incorporating the Common Essential Learnings into instruction. Implementation of the C.E.L.s will occur as new curricula are developed and implemented.**

Because these statements are fundamental to understanding the relationship between the C.E.L.s, the Required Areas of Study, and other school subjects, they require further elaboration.

First, the Common Essential Learnings are perspectives which influence school subject matter and how it is taught, but they are not school subjects themselves. The incorporation of the C.E.L.s into Saskatchewan's core curriculum framework does not mean that teachers will be expected to teach new courses such as critical thinking or independent learning. Rather, the C.E.L.s are to be incorporated into new curricula so that students will be helped in learning how to think critically or acquire some strategies to learn independently within each school subject. The knowledge, skills, processes, attitudes and values contained in the C.E.L.s will be acquired through school subject matter matched with appropriate methods of instruction and a supportive school environment, but not through the direct teaching of any one C.E.L. in isolation from school subjects.

Second, students will not be evaluated on their acquisition of the C.E.L.s independently of school subject matter. The C.E.L.s depend on school subjects for their content, depth and breadth and are shaped in different ways within different subjects. For example, critical thinking in arts education involves different concepts and abilities than critical thinking in mathematics or in social studies. It is necessary, then, that assessment of students' acquisition of the knowledge, skills, values or processes associated with the C.E.L.s be achieved largely through assessment within the school subjects. Teacher, peer and self assessments of progress toward achieving the abilities related to Personal and Social Values and Skills, however, will be influenced by subject area learning and by the whole of the school experience.

Third, while the C.E.L.s are discussed as though they were separate and distinct, they contain many of the same values, attitudes, knowledge, skills and processes. Achievement of growth in one of the Common Essential Learnings supports growth in the others and the various C.E.L.s may be developed through similar teaching practices. One lesson can develop abilities and understandings of several of the Common Essential Learnings. Overlap and interrelationships can be expected. The recommendations and understandings of the other C.E.L.s apply equally to Independent Learning. As a consequence, individual chapters in this handbook should be read with the realization that understandings developed when discussing a particular Common Essential Learning may also apply to other C.E.L.s. For example, the discussion of the teacher's role in developing Personal and Social Values and Skills applies equally to and supports the development of Critical and Creative Thinking. While it is beyond the scope of this handbook to provide detailed lesson plans for incorporating the C.E.L.s into the Required Areas of Study, the chapter on Communication contains more specific information related to instructional strategies than subsequent chapters. It is hoped that the other chapters benefit from this initial elaboration and that understanding of how to develop appropriate instructional strategies will

increase as the reader progresses through the handbook.

Fourth, educators will achieve greater understanding of the depth and breadth of each Common Essential Learning as new curricula are developed which incorporate them. Incorporation of the C.E.L.s into teaching practice will be supported through on-going inservice developed by Saskatchewan Education in co-operation with key educational organizations and through the on-going development of teaching materials related to the C.E.L.s. It is intended that this handbook together with the initial inservice will provide teachers with the foundational knowledge required **to begin incorporating** the C.E.L.s into instruction. Responsibility for implementation of the C.E.L.s will occur as new curricula which integrate them with the Required Areas of Study are developed and implemented.

Foundations for the Common Essential Learnings

The Common Essential Learnings promote active, self-motivated and increasingly independent learners. They are intended to direct content and instruction in ways that will provide students with an integrated and meaningful knowledge base, as well as the understanding and processes necessary to achieve personal autonomy and compassion for others. The C.E.L.s are based upon certain foundational beliefs about the teaching-learning process and the teacher's role, and are developed in part from Saskatchewan's Goals of Education (1984).

Goals of education

The Common Essential Learnings (incorporated into the Required Areas of Study) support the achievement of Saskatchewan's goals for education. Such important goals as "working to create greater social justice" and "participating in the democratic process of governments" are developed through Personal and Social Values and Skills and Critical and Creative Thinking. Life-long learning goals such as "acting as a self-reliant learner, capable of autonomous learning" are developed through such C.E.L.s as Communication, Numeracy and Independent Learning. The promotion of Technological Literacy supports goals such as "making informed consumer decisions" and "respecting and seeking to enhance the environment." The emphasis provided by the C.E.L.s is one of developing persons committed to both reflection and action, and to participation in the **shaping** of the future rather than reacting to change. Finally, the C.E.L.s emphasize that one should analyze personal needs in the context of respect for the environment and respect for others.

Teaching-learning process

Foundational beliefs about learning (*Program Policy Proposals*, Saskatchewan Education, 1986) which led to the development of the Common Essential Learnings can be summarized as follows:

- There is more than one type of learning. For example, acquiring information makes different demands upon the learner than acquiring skills, processes, attitudes or values. For this reason, different types of learning may require different methods of instruction.
- Learning is a function of the total environment and is the result of an interactive process, with both students and teachers having an influence on the outcomes of any interaction.
- Important factors which influence learning include: relevance of the content and methods to the learner's interests, needs and goals; congruence with developmental levels of the learner; and allowances for active participation of the learner.

The individual C.E.L. perspectives contain - either implicitly or explicitly - **an emphasis on learning in order to understand and to apply knowledge in daily life, rather than simply learning by rote.** This emphasis requires a compatible vision of the teaching-learning process. The central principles of such a vision can be described in the following manner.

What children learn depends not only on **what** they are taught but also on **how** they are taught, their **developmental level**, and **their interests and experiences**. In other words, there is not a direct equation between what is taught and what is learned. These beliefs require that much closer attention be paid to the **methods** chosen for presenting material, as well as the ways in which **mediating influences** (such as economic circumstances, cultural background, special talents or abilities) affect students' learning. While the goals of the Common Essential Learnings apply to all students, it needs to be recognized that not all students will reach these goals to the same extent or in the same way. For example, expectations for students with special needs are shaped by their particular abilities or disabilities.

Another fundamental of a teaching-learning process shaped by the C.E.L.s is that meaningful

learning depends on giving students opportunities **to be actively involved in knowledge construction**. This does not mean totally embracing a discovery approach to learning, nor does it mean abandoning lecture and drill as methods of teaching. It does mean that new curriculum developments will include analyses of which types of knowledge are best acquired through lectures, memorization or practice, and which are best achieved through teaching methods that lead students to make the important connections themselves.

Teacher's role

"The teacher has to teach both students and subjects, and to do that, he or she must reconcile respect for the child and respect for what is being taught." (Lazerson, McLaughlin, McPherson and Bailey, 1985, p. 109)

Teaching is a learned profession, and many of the demands made on teachers relate to their being part of a scholarly community. Teaching requires an understanding of several categories of knowledge, including: content knowledge derived from the various disciplines; general pedagogical knowledge; curriculum knowledge; knowledge of learners and the learning process. In addition, teachers need to have: knowledge about education as an institution with its own rules and regulations, as well as education's relationship to the larger community and the government; knowledge of educational goals, purposes and values; and understanding of how the body of knowledge in each of these categories is built, codified or changed.

While teaching has technical aspects which can be analyzed and prescribed, it is also a dynamic and reflective process. Changing and improving instruction has implications for teachers' personal values and beliefs and is dependent in part on their unique abilities and experiences. Teachers' understandings of curricula and instruction will grow out of meaningful and concrete learning situations - just as they do for students. Teachers play a critical role in incorporating the Common Essential Learnings into school subjects. The demands of this process are best supported by a belief in the potential of the C.E.L.s to strengthen and enrich students' present learning and future lives.

Summary

The purpose of this handbook is to enable teachers to proceed from understanding to action - from understanding the basis of the Common Essential Learnings to practical incorporation of the C.E.L.s in the classroom.

The C.E.L.s contribute to the quality of students' education by equipping them with tools useful both within and outside the classroom. That is, the Common Essential Learnings will assist students in better acquiring the subject matter, values, skills and processes that make up their school subjects, as well as developing the abilities needed to function as rational, responsible, and compassionate members of society. The teacher's role is central to improving students' understanding and learning in all of these areas.

Chapter II: Communication[1]

The **goal** of incorporating **Communication** into Saskatchewan's K-12 curricula is to promote students' **learning** in all school subjects through improving their language abilities within each subject. What is desired are students who can bring order and meaning to facts and experiences and communicate that understanding effectively to others.

Definition

Communication as a Common Essential Learning focuses on the language demands of each school subject. The role of the teacher is central to improving students' understandings through the development of communication abilities in all subjects. Thus, Communication is described largely in terms of instructional strategies necessary to help students with this task. It does not require that all teachers become language arts teachers, nor does it replace teachers' responsibilities for teaching the content and processes of other school subjects.

As a C.E.L., Communication recognizes first, that the language requirements of all school subjects must be clarified, and second, that teachers must be supported as they assume responsibility for these requirements. **The over-riding purpose of such clarification and support is to assist students in coming to a better understanding of all their school subjects.**

Rationale

Communication is based on three important principles which demonstrate the relationship between language, thinking and learning.

1. **Learning in all subjects is developed in and through language.** Learning and growth in language abilities in the four language modes--listening, speaking, writing and reading--are inter-connected and inseparable from learning in each individual field of study. This means that growth in language abilities is necessary for the continuous development of understanding in any school subject.
2. **Growth in language abilities takes place as a result of planned language experiences in all four modes - listening, speaking, reading and writing.** One learns to write as one learns to speak as one learns to read and listen. Each ability improves to the extent that all are exercised.
3. **Each school subject possesses unique (as well as common) language requirements.** For example, while reading a literary passage in order to develop a response to its tone or mood, one needs to have a feel for the overall flow of the passage and suspend word by word analysis. Developing understanding of mathematical problems or algebraic equations, however, requires that one pay attention to each word or individual unit. This suggests that language instruction needs to be incorporated into all courses of study. Language instruction within school subjects (other than English Language Arts) should focus on the language demands of each subject in terms of teacher talk, textbook language, and the specialized vocabulary and structured forms of expression unique to that subject.

   The interrelationship between language, thinking and learning is further clarified through an understanding of how students learn. Knowledge exists in the minds of knowers, and students do not develop or acquire knowledge until they can put information into an ordering which has meaning. Language is the means that students generally use to bring order and meaning to facts and experience, either by speaking or writing, or by inner monologue of thought. It is largely by means of language that the school expects learning to take place.

   One of the aims of education is to help the student achieve full potential as a language user (including alternative and/or augmentative forms for those students unable to use verbal communication). To support this aim, awareness of the diversity of students' needs is important. When speaking of language, it needs to be remembered that language includes alternative forms of communication such as signing, manual communication systems, electronic communication devices and braille. These forms are important not only for students with exceptional needs, but also for people with whom these students may wish to communicate. It is recognized that adaptations may be necessary for students with special needs. It is also important to recognize that communication

1. The work of Trevor Gambell (*Communication Across the Curriculum*, Saskatchewan Education, 1987) has been used extensively in formulating this chapter.

may take different forms in different cultures. Cultural differences in aspects of communication such as silence, eye contact and ways of expressing emotions need to be respected[2]. **When developing Communication, it is critical to be sensitive to cultural norms.**

Language develops in use, in response to the demands put upon it by learning in different subject areas, as well as students' life experiences. The language that evolves in a particular situation is shaped by a number of factors, including:

- the nature of the speaker or writer and the audience;
- the relationship that exists between the two;
- the purpose in speaking or writing;
- the nature of the subject; and
- the medium being used.

Language development is enhanced by the opportunity to use language in many different situations in order to deal with a wide variety of tasks.

Through language, students acquire most of their learning. Methods of inquiry, recording, reporting and theorizing are linguistic processes, sensitive to the context in which they take place. It is in the school's power, as the context in which the learning of the Required Areas of Study takes place, to facilitate these processes. It is through language used for clearly perceived learning purposes that students acquire understanding of what a school education offers. Schools need to become places where understanding of the nature of language as well as general learning can proceed in an integrated manner through reading, writing, speaking, and listening.

The Teacher's Role

Communication as a C.E.L. supports teachers in their efforts "to increase and/or vary the language experiences that help students understand and explore the subject matter and processes of the Required Areas of Study" (Gambell, 1987, p. 16). Students need to become literate in the language of each subject area. Teachers of each subject can help with this achievement by:

- having students participate in directed talk about the subject matter at hand (with the help of a teacher-prepared discussion guide) in pairs, small groups and large groups;
- providing opportunities for practising the language of each subject area in different modes (listening, speaking, reading and writing) at different levels of complexity and formality related to the concepts of audience and purpose;
- taking students through a section of text, showing them how the subject presents its information and how it links facts or arguments in a particular way, or setting questions that help students identify these techniques for themselves;
- assisting students in the process of organizing information in subject areas (sorting, selecting, summarizing, outlining, taking notes, reviewing, previewing, and reporting on material);
- developing students' study skills through activities such as, analyzing material with students and brainstorming a number of questions or assignments that **could** be given, or having students compose questions themselves;
- working with the teacher-librarian in the library resource centre to show students where subject area resources are located and how to make use of these resources.

Generally, teachers will need to place a great deal more emphasis on **expressive language**,[3] both oral and written, as students come to terms with learning in the subject areas. Having greater awareness of the contextual nature of language and learning suggests that teachers should use a variety of instructional contexts - including individual, small group, whole class, pairs, and even across-age groupings - to take advantage of different language and learning possibilities. Teachers should be aware of the different capabilities of students at different ages, as they deal with language in the various modes--listening, speaking, reading and writing. Students' development in language, thinking and learning is enhanced when teachers:

- provide students with examples of language - how it looks, works and is used (e.g. labels for classroom objects, charts on classroom walls, books displayed on shelves or ledges);
- value their students' existing language competencies and plan learning experiences that build on these;
- provide opportunities for second-language students to draw upon their first-language skills in order to allow students to engage in higher order thought processes such as generalizing, hypothesizing, persuading, arguing and reporting;

2. See *Cross-Cultural Communication*, Session 2, Phase II Inservice, (1981), Community Education Branch, Saskatchewan Education, for further discussion of cultural differences related to language and communication.
3. Expressive language is language that is personal - it reflects a person's own understandings. It is the basis for growth in more formal uses of language.

- provide extended wait time to allow for students' reflection and solicit responses in such a way that each student has an equal opportunity to respond;
- follow student responses with requests for clarification, elaboration, extension and evidence;
- provide opportunities for tentative, exploratory and inexplicit discussion in small groups;
- set some pre-listening, pre-speaking, pre-reading and pre-writing activities such as brainstorming, prior questions or personal reflective writing;
- provide assignments which incorporate process writing and meaningful classroom talk and listening such as: student journals and logs, small-group projects, student-teacher dialogues, role playing and educational drama;
- further develop thinking (both the level and type of thought) through the language which teachers use themselves and require of students, including analysis, reasoning, formulating, synthesis and decision making;

Teachers' roles in fostering Communication abilities often overlap and reinforce their roles in fostering other C.E.L.s - such as Critical and Creative Thinking and Independent Learning. While the examples in this section focus primarily on strengthening capabilities in meeting the language requirements of the various school subjects, many of the suggestions for instructional strategies have wider implications.

Students' language needs

Studies of the problems which teachers most frequently encounter in students' writing and

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reading abilities in the content areas[4] typically include the following situations and difficulties:

1. Students often copy sections of text, rather than attempting to translate the text or reference book into their own words.
2. Many students can recognize and pronounce the words but do not understand what they read.
3. Often students cannot write clearly and logically about what they have read.
4. Students frequently cannot apply what they have learned from a text or lecture to a new situation or context.
5. Many students have limited vocabularies which restrict their reading and writing potential.
6. Many available textbooks are too difficult for students, and teachers have to translate them for students.

Working from concerns such as these, strategies have been developed which assist students in understanding and applying subject matter from the content areas. The activities which appear to be most useful are those which focus on having students **think through and actively construct the meaning of texts, lectures or films for themselves, and which require students to translate this knowledge into another form** (such as concept mapping and diagramming). Retention rates from such activities are longer and material is more likely to be related to previous knowledge, past experience and/or other areas of study. Activities which incorporate listening and speaking in pairs, small or large groups with reading and writing activities promote the most growth.[5]

Such activities can be categorized to reflect students' needs in the content areas (cited previously as frequently encountered problems). These categories include: preparation for reading, listening or viewing; reflection on text read; extraction and organization of text; and translation and sharing of new learning. While two of these categories will be discussed briefly, the list of practical resources related to Communication (see Appendix A) provide support in all of these areas.

Preparing for reading, listening or viewing

Whenever we learn something, we make connections or forge links between what we already know and what we are learning. At the same time, learning something new involves putting aside content judged to be irrelevant. This dual process involves thinking that is not simply receptive (where students passively take something in), but rather **thinking that is active and constructive.** To engage students in this type of thinking-learning activity is one of the surest ways to promote genuine understanding of content. Understanding can be fostered through preparatory activities, such as questioning of various types, discussion, analysis and categorization tasks, and process writing.

Whether students are in kindergarten or in grade twelve, exploration of a topic within one of the content areas proceeds best when linked to an activity which focuses students' thoughts on the underlying meaning of the topic. Meanings can be personal, reflecting students' own experience related to the topic, or meanings can be more formal, exploring for example, the relationship between the new topic and knowledge of other school subjects.

The strategy of having students establish prior questions is valuable at any age. Teacher questioning and discussion in an introductory or preparatory lesson should be designed to elicit responses from students about what they already know on the topic. The second step in such a process would require students to reflect on what they don't know and what they would like to know about this same topic. Such exploration can be achieved through a variety of formats. Some appropriate methods, beginning with students in kindergarten, are class brainstorming and preparation of the group's set of questions

4. See for example Part 3 of Morris and Stewart-Dore's *Learning to Learn from Text*, Addison-Wesley. North Ryde: 1987.
5. See the Practical Resources at the end of this handbook (Appendix A) for a list of books which examine in more detail the arguments presented here.

(recorded on an experience chart). Teachers of older students may ask their classes to reflect on the topic, and then to write individual sets of questions. In all grades, such an initial activity should be followed by an activity at the end of the unit which leads students back to their original questions, in order to see if they have been answered.

A somewhat more formal technique used to prepare students for new learning is that of the structured overview or concept map.[6] One version of this activity requires that teachers think through and articulate the important concepts in a new unit, chapter or film before introducing students to this same material. Teachers print these concepts on sheets, which are cut into cards by students. Students are instructed to read the words or phrases on the cards, then to sort them into two piles of concepts - first, ones they are familiar with or have a basic understanding of, and second, ones they don't understand. Recording and working specifically with the collection of concepts that students do not know is a useful offshoot of this activity. Students could also be expected to work further with the concepts they do know, arranging them on their desks to reflect their present understanding. They could move cards closer together to demonstrate which concepts belong in the same category, or alternatively, order them from the most general or inclusive concepts (top of their desk), to the sub-topics (middle), to specific examples of sub-topics (bottom).

Figure 2.1 illustrates a concept map developed through Novak & Gowin's (1984) strategies for concept mapping. In this activity students (or teachers) select 6-8 concepts they consider to be centrally involved in the exploration of a particular topic. Once the key concepts are identified students begin either individually, in pairs or in small groups to rank order the concepts from the broadest, most inclusive concept to the more specific, least inclusive concepts. Students then construct a "map" starting with the broadest concept at the top of their sheet and proposing relationships between concepts through parallel as well as hierarchical connections. Prior questions and concept maps are two preparatory devices which help students focus on the ideas contained in new material.

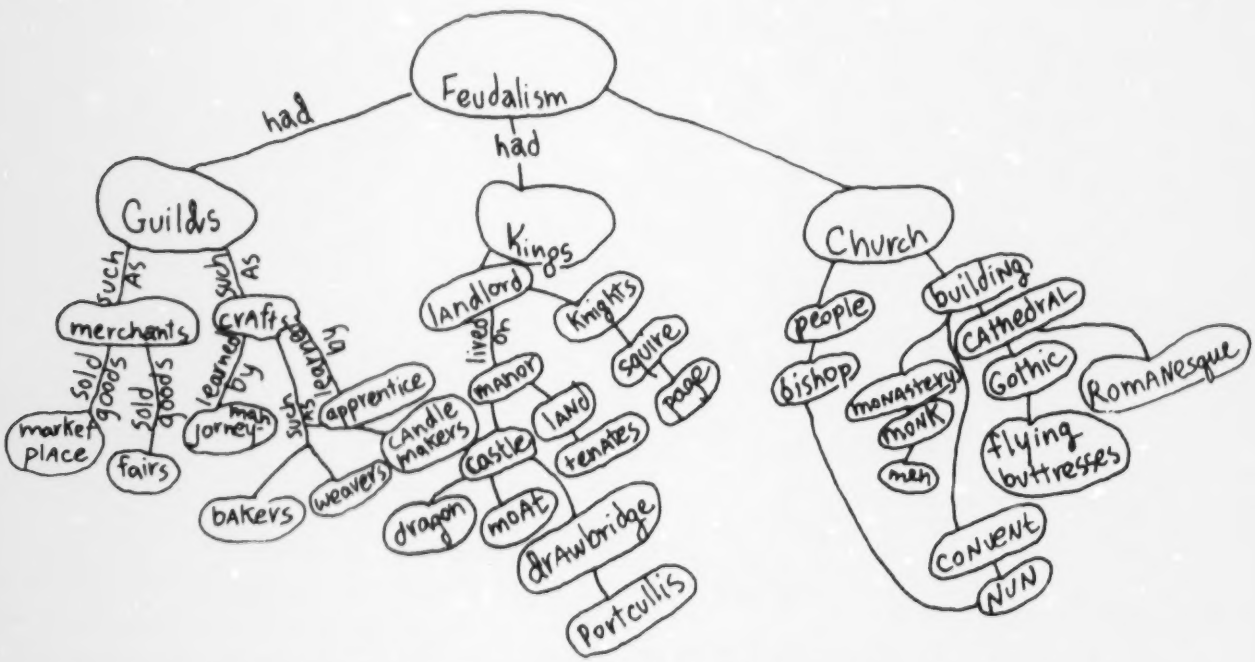


Figure 2.1 A concept map for history prepared by a previously low-achieving student in sixth grade from Novak & Gowin's (1984) *Learning How to Learn*. Reprinted with the permission of Cambridge University Press.

6. See Novak and Gowin's (1984) *Learning How to Learn*, and Morris & Stewart-Dore's (1987) *Learning to Learn from Text*, for two complete and differing descriptions of this technique.

Extracting and organizing information from content

Much new information that is presented to students comes in the form of material which they are required to read. Strategies for helping students make sense of what they read in the content areas include those which **focus attention on the underlying structure** or framework of how the text or section of text is organized. All print materials in schools do not follow an ideal and consistent structure. This lack of consistency makes extracting and organizing material a difficult task for most students.

Beginning in the middle years, teachers should assist students in developing some common structures for reading factual material. Students should become familiar with and recognize a number of the most common structures, including:

- ideas, people, situations or settings are compared or contrasted one with another;
- main ideas are broken into sub topics;
- sub topics are supported by examples;
- solutions are suggested to problems;
- items in a category are listed; such items may be described in word, sentence or paragraph units (that is, lists are not always lists of words);
- causes are explained in terms of their effects.

Just as young students come to recognize predictable story patterns, older students should come to recognize organizational structures. Reading the table of contents in a variety of textbooks as the basis for discussion of some common organizational schemes, would be a useful preliminary activity in any of the content areas. Having pupils draw **diagrams** which summarize a text, chapter or passage is also helpful. Teachers might present several types of diagrams as models, such as graphs or flow charts, but students should be encouraged to develop their own diagrams whenever possible.

In order to help improve their ability to extract and organize information from the printed page, secondary students can be asked to develop **graphic outlines**. These graphic outlines can later be converted into conventional outline form. Figure 2.2 illustrates one example of a graphic outline, developed from a science textbook. Teachers should keep in mind that these diagrams are used as aids for students' understanding and thus should not be assessed as projects in draftsmanship.

Organizing print material into **a visual display** is a valuable small group activity which stimulates understanding, because it requires so much re-reading and checking of facts. At the same time, it gives teachers an effective way of assessing students' levels of understanding.[7]

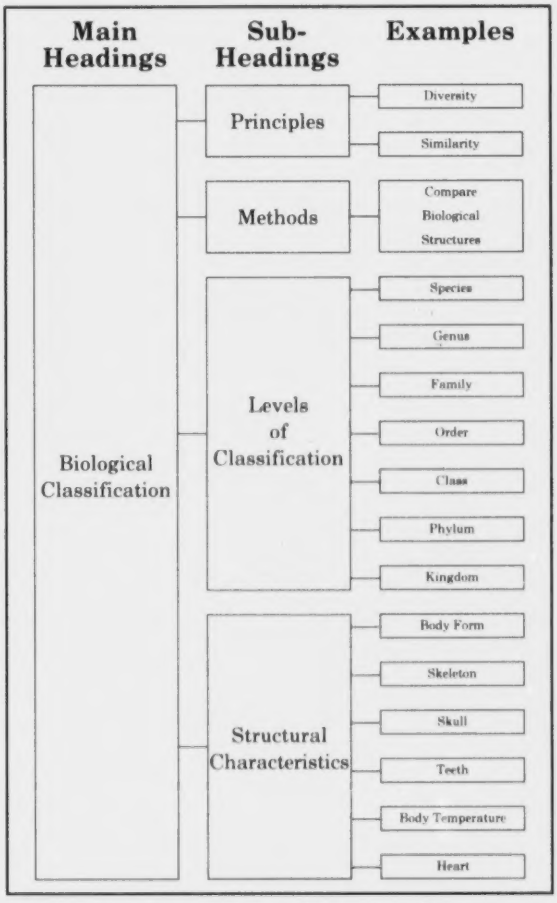


Figure 2.2 A graphic outline of a chapter on animals developed from a grade 10 science textbook.

Many activities promote meaningful learning in the content areas. One final activity discussed here is that of **note-making**. The making of notes is an intrinsic part of learning, which can help students better organize and understand information from text, talk or film. It is an activity which is useful for research and essay writing, as well as for studying.

Teachers have a role to play in helping students develop the ability to make notes. In the early years, children need to be encouraged to put ideas and information into their own words. Asking students to share with their classmates a sentence about the

7. Descriptions of diagramming and outlining techniques can be found in Morris & Stewart-Dore's (1987) *Learning to Learn From Text*.

report they have just heard or the program they have recently watched, can lead to thinking about the main idea of the presentation. After students' initial offerings are given, teachers can focus discussion further with comments and questions such as: "We have heard a lot of things that people remember about the book I just read. What do you think is the most important part of the book?"

By the time students have some rudimentary abilities in reading and writing, they should be encouraged to summarize new information by writing one or two sentences which describe what they have learned from an activity, book or film. Young students should also be given tasks such as writing down one word which best tells what a book, recording, or film was about.

In the middle years, note-making should be preceded by having students set **prior questions** (as individuals or in groups) which will guide them in looking for specific information. Two activities which are useful for middle-years' students include:

- having pupils make a set of notes on a short selection (2 - 3 pages) which they have read;
- having students make notes on a short passage which a teacher has read to them.

In both instances, students profit most from the sharing and group discussion which follow such an activity. During discussion, teachers will need to find ways to have students reflect on some of the following observations:

1. It is advantageous to wait until you have read or heard the entire selection before beginning to make notes (providing the selection is relatively short).
2. In note-making, students must pay attention to **economy** (keeping the notes brief), **precision** (making the point clearly and accurately), and creativity (finding ways to organize notes that work best for them and best express their own thoughts and understanding).

Note-making activities should be accompanied, at least part of the time, by an activity where the notes are used or applied - such as using the notes to give a talk to the class, or as the basis for writing a short research summary or report. Continuing into the secondary school years, students need opportunities to use note-making as a **thinking** activity - one which links their reading, viewing and talking with their writing.

Some general guidelines for developing students' abilities with regard to note-making and report writing include:

- setting up purposeful note-making tasks based on the content being taught;
- involving students in discussing ideas and thereby checking on their understanding of what they have read (or viewed or heard) before they begin note-making;
- insisting that students write projects and assignments in their own words;
- providing students with time in class to talk about and develop their own notes and reports;
- providing students with clear guidelines on content, presentation, approximate length and assessment criteria for reports;
- beginning a lesson with sustained writing about the previous day's work, starting with key words, extending into sentences and linking sentences into paragraphs.

Finally, it should be noted that the preceding discussion of note-making and other strategies for organizing information are consistent with the role of the teacher-librarian in a resource-based learning approach. Co-operation between teacher and teacher-librarian in incorporating Communication strategies into library research projects is important.

Summary

To summarize the theory and practice of promoting Communication:

- **learning in the content areas should promote understanding over memorization;**
- **teachers need to think through and organize their knowledge in each subject they teach, in a way that helps them understand it and see the language areas where students may have difficulty;**
- **teachers should be supported in finding ways to engage students in language tasks related to the ideas, the organizing structures and the vocabulary of their subjects.**

Chapter III: Numeracy[1]

The **goal** of incorporating **Numeracy** into Saskatchewan's K-12 curricula is to develop individuals who can cope confidently and competently with everyday situations demanding the use of mathematical concepts, as well as developing their ability to learn new concepts when necessary. What is desired are students who know **how** to compute, measure, estimate and interpret mathematical data, know **when** to apply these same skills and techniques, and understand **why** these particular processes apply. Further, Numeracy is intended to strengthen students' learning in all school subjects through providing them with grounded understanding of the quantitative aspects of each subject.

Definition

Numeracy can be described as the knowledge, skills and appreciations needed for students to understand and utilize mathematical ideas, techniques and applications. Numerate people demonstrate an "at-homeness" with numbers and are able to understand information that is presented quantitatively: in graphs, charts and tables; through reference to percentage increase or decrease; and in timelines. Numeracy involves students in integrating such skills as **interpreting quantitative information, performing straightforward calculations mentally, estimating values that are known and unknown, and developing an intuitive knowledge of measurement units.** See Figure 3.1 for an overview of **some** of the skills, abilities and processes which underly Numeracy. It should be noted that this visual representation is not meant to be comprehensive or prescriptive, but rather to be descriptive of this area. This framework can be helpful in determining those aspects of Numeracy which can be incorporated into a particular subject area. Educators are encouraged to evaluate the usefulness of this framework in designing appropriate learning activities as they become more familiar with incorporating Numeracy into their teaching.

Students **need not master** all of the skills, abilities and processes represented in Figure 3.1 in order **to be numerate**. This depends on their individual ability and level of development. Alternative processes and basic skills are needed for students with severe disabilities, as some students may not proceed beyond simple ordering, one-to-one correspondence or an elementary knowledge of numbers. Conversely, capable students should **not be limited** by the skills, abilities and processes represented in this figure.

Rationale

A focus upon Numeracy in Saskatchewan's core curricula is justified by the **demands of modern life** - both within and outside the workplace. It is also justified by the demands of acquiring an education.

Numeracy can be considered as a way of knowing - one which helps students better understand all of their school subjects. Strengthening students' mathematical abilities by exercising them in other subject areas may offer students another means of comprehending these subjects. Increasing students' opportunities to **apply** their numeracy skills should result in more students integrating them into their everyday understandings.

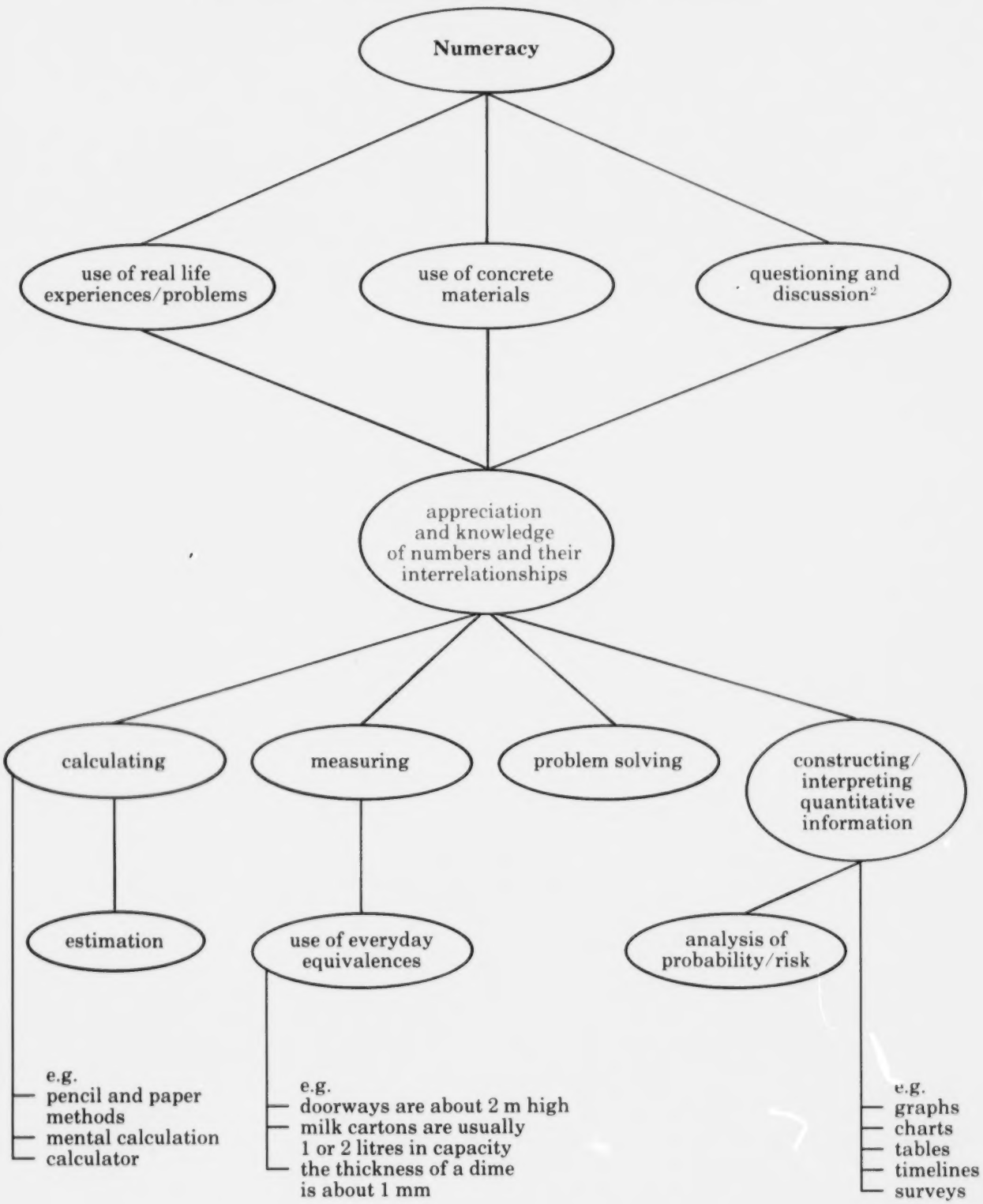
An examination of the demands of modern life (such as that undertaken by Hope, 1987) reveals that numeracy skills are drawn upon daily. Numeracy demands encompass a number of routine tasks such as counting objects, reading clocks, counting money and finding the page location of a book. Non-routine tasks such as completing an annual tax return or estimating the amount and cost of new carpeting are often accomplished with outside help. Adults do, however, exhibit flexibility of thinking while performing everyday tasks and tend to select techniques according to a number of criteria, including: the purpose of calculation, the degree of precision and accuracy needed, the size and types of numbers, and (most importantly) helpful contextual cues in the environment. For example, shoppers use a variety of ways to compare prices and take into account contextual cues when they compare the prices of two products of equal size or quantity.

A great variety of mathematical demands are placed on people in contemporary Canadian society (both inside and outside educational institutions); a review of these demands illustrates the general types of abilities and competencies required. These can be discussed under the general headings of: data analysis and interpretation, calculation, and measurement.

1. The discussion of Numeracy in this chapter makes extensive use of the work of Jack Hope (*Numeracy*, Saskatchewan Education, 1987).

Figure 3.1

Numeracy: Some Key Elements



2. Through questioning and discussion, students' thinking can be explored with regard to calculating, measuring and problem solving. By talking about their thought processes, students can share how they "see" a problem and discuss alternate strategies.

Data analysis and interpretation

Computers are forcing more and more members of society to become familiar with numbers and statistics, and in particular **the interpretation of quantitatively expressed information.** Most government agencies and business groups produce statistics. Business managers, administrators, public servants and consumers need to be sufficiently numerate to interpret the data that are now routinely used for decision making. Consumer reports, cost of living indexes and surveys are examples of data-oriented messages that people receive and need to process. Adults see graphs, tables, charts, scales and dials almost every day and are expected to synthesize information from them. In order to function in an information society, it is essential for students to **learn how to read and interpret quantitative information** which may be presented in tables of figures or visually displayed in graphs.

Calculation

One of the most common mathematical tasks carried out by adults is that of calculation, using pencil and paper methods, calculators, mental calculations and estimations. Adding, subtracting, multiplying and dividing with whole numbers are done frequently, but rarely with large numbers. Multiplying and dividing usually involve only one-digit factors and divisors. Adults use a wide variety of methods for such tasks; these methods are usually either self-invented or taught by other adults.

Calculations involving decimal fractions to two places are common in relation to money - especially addition and subtraction. The **use of percentages** is widespread in laboratories and offices; again, most uses involve money. Since the changeover to metric few common fractions are seen, but **recognizing fractional parts** such as halves and quarters is needed by most people. Common fractions almost always have denominators that are powers of 2, such as 2, 4, 8 and 16. The ability to calculate with whole numbers and fractions increases students' understanding in subject areas such as social studies (e.g. calculating the population density or GNP of a country).

In order to increase speed and accuracy, and ultimately productivity, most employers encourage the **use of calculators** for the tasks described above. Calculators are faster, and in many instances, more accessible than computing with pencil and paper. Opposition to the use of calculators in classrooms or workplaces may be based on the fear that students will not gain knowledge of basic calculation skills or that workers will fail to notice errors produced by the inappropriate use of calculators. These difficulties can be largely overcome by instruction in the optimal use of calculators, supported by instruction in estimating approximate answers in order to check the accuracy of calculations.

In a large number of situations, there is no choice but **to estimate** because exact values are not obtainable. Predictions about the future, guesses about the past, and estimates of military strength would fall into this category. Sometimes estimates are easier to use and are clearer than the more precise actual figures. For example, a newspaper headline may state that the population of a city is 30 000 people, instead of using the actual figure of 29 876. Further, the use of estimates usually gives consistency. Government reports on the percentage of people unemployed give that percent to the nearest tenth and sports columns customarily round off a winning "percentage" to the nearest thousandth.

The **ability to estimate** is a highly valued work skill and can take several forms. Numerical estimation is used to detect calculation errors produced by calculators or pencil-and-paper methods. Another form of estimation involves measurement, as some decisions often have to be made based on visual inspection. Although skills of measurement estimation develop further on the job, it is essential that workers demonstrate an intuitive knowledge of or "feel" for measurement units. Students' understanding in the Required Areas of Study and other subjects is increased when they are able to estimate the accuracy of calculations or the length of time a particular assignment, such as an essay, will require.

Measurement

A knowledge of measurement is vital. Even adults who do not take an active part in the measurement process need to be aware of the meaning of measurement, as they are likely to be consumers of measurement information - ordering supplies, calculating profit margins, or evaluating the success of a program.

Understanding in school subjects such as science also require that students have a feel for measurement, understand the options presented by specific measurement situations and take into account their margin of error.

Summary

In the future, the numeracy demands of adult life will be less concerned with complex pencil-and-paper calculations, since technology will continue to replace such skills. The focus of Numeracy will shift to other abilities, such as:

- **interpreting quantitative information;**
- **performing straightforward calculations;**
- **estimating values that are known and unknown; and**
- **developing an intuitive knowledge of measurement and measurement units.**

Regardless of the future advances in technology, all members of our society should be sufficiently numerate to be able to do the following tasks independently and with a minimum of intellectual effort:

- **wise consuming** (e.g. reading prices, calculating costs);
- **homemaking** (e.g. measuring, reading gauges);
- **reading, interpreting and evaluating quantitative information found in newspapers, popular magazines and other publications;**
- **using and working with common technological devices** (e.g. cars, calculators);
- **participating in and enjoying leisure activities, games and sports;** and
- **adapting to new mathematical demands as needed** (e.g. learning new employment skills, using instruction manuals).

School subjects will continue to pose quantitative as well as qualitative demands upon students' learning. Thus the knowledge, skills and values of Numeracy are necessary to support present learning and future life. How teachers can support the achievement of Numeracy is the focus of the discussion which follows. See Table 3.1 at the end of this chapter for an overview of **some** of the student and teacher behaviors that might be seen when developing Numeracy.

The Teacher's Role

Mathematics teachers will continue to be primarily responsible for developing an understanding of mathematical concepts, rules, principles, relationships and procedures, but Numeracy must also be supported in other subject areas. **Almost all subjects can include some meaningful opportunities for students to apply mathematical knowledge.** Most students in the elementary and middle grades learn best if they are involved in meaningful activities that require the use of manipulative materials. Secondary students also benefit from hands-on experiences with instruments and tools. **A great deal of discussion and work with concrete materials should precede any introduction of symbolic abstractions.** Opportunities to support the achievement of Numeracy can be discussed under the general headings of: problem solving, calculation, measurement, space and shape, and data analysis and interpretation.

Problem solving

If students encounter only the simplest of problems, or use formal procedures they don't understand when solving problems, their approach to problem solving can become mechanical. For example, an 11 year-old student explained this approach to solving problems: "Problem solving is easy. If there are more than two numbers, I always add; otherwise, I subtract. If I'm not sure if it's multiplication or division, I divide and, if there is a remainder, I multiply instead" (Hope, 1987, p. 57).

When students are given problems to solve, instruction should focus on the understanding of the problem statement, the analytic tools or

general problem-solving strategies that might be profitably used, and the assessment of the reasonableness of a solution. Even after a solution has been determined and discussed, analysis of the problem should continue. Students could discuss other methods of solution, make any generalizations, and show how other problems could be created by changing some of the features of the original problem. A few problems studied intensively contribute far more to developing the ability to solve problems than many problems treated superficially.

It is important to include examples of real-life problem solving in all school subjects, especially those problems that require continual reformulation, involve the collecting of information, and allow students to try a number of methods of solution - including ones that may not appear to be mathematically elegant.[3] To discuss and solve real-life experiences, a teacher of second-language and other special needs students must be well aware of the level of language competency of students and then direct discussion through appropriate questioning in order to make use of what students know.

By participating in practical activities, students develop their abilities to carry out routine tasks and approach non-routine problems with some confidence that solutions can be found. Experiences with real-world problem solving can begin as early as Grade 1, using simple examples such as deciding how many sheets of paper are needed by the class for an art project. Older students can estimate the amount of food or money needed for a 3-day class trip. A school subject such as social studies can provide students with the opportunity to participate in examining solutions to real-life problems, such as inner-city poverty or where to locate a community recreation centre.

Calculation

Opportunities for students to practise and apply calculation skills can be found in all school subjects. In the Required Areas of Study, students can be encouraged to select the most appropriate means of performing any necessary calculations from pencil-and-paper methods, calculators, mental calculations, and estimations. Although not a replacement for thinking and reasoning, the hand-held calculator can provide teachers with additional time to help students become numerate. It is critical, as well, that students learn to distinguish between appropriate and inappropriate uses of calculators. "Just as literate people do not rely entirely on a dictionary to carry out their daily communication tasks, numerate people do not rely entirely on a calculator to carry out their computational tasks" (Hope, 1987, p. 70).

Despite the obvious advantages of using calculators, **the ability to calculate mentally and to provide quick estimates of the accuracy of a calculation,** whether produced electronically or manually, continues to be extremely useful. Since the great majority of everyday problems are solved mentally, it is important that students are taught a variety of ways to calculate in their heads. Once the students understand how and when to apply a mental calculation technique, practice is needed to increase speed and accuracy.[4] Students also require considerable help and practice if they are to learn to distinguish between situations calling for rough estimates or exact answers.

Measurement

Teachers can develop students' **intuitive notions** of mathematical concepts through practical activities with varied materials. Students can perceive the attributes of mass (weight) by comparing the differing weights of objects balanced in their hands. By pouring liquids from one container into another, students can observe

3. See Lesh (1985) for an example of such a problem.
4. See the Practical Resources at the end of this handbook (Appendix A) for a list of publications for mental calculation and estimation.

the properties of volume. Direct experiences related to measurement ideas can lead students to realize that area requires a "covering" of surfaces and perimeter forms a "boundary" around those surfaces. If students have an intuitive notion about what they are measuring, they will be able to distinguish between--and be less likely to confuse - measurement processes which appear to be similar. Unconventional instruments and non-standard measurement units, such as feet or hands, can be used initially to help students develop an understanding of the measurement process.

Students of all ages benefit from experiences in carrying out measurements using a variety of conventional measurement tools. Providing students with extensive practical work ensures that they will have less difficulty in learning to use and select tools and instruments encountered outside of school. Whenever measuring takes place in any subject area, it should be done primarily for the purpose of gathering data needed for the solution of a problem, with some discussion about precision and error and their effects on computation.

Perhaps the most significant contribution schools can make to a student's understanding about the nature of measurement is **the establishment of a wide variety of everyday equivalences** that can be used whenever measurement units are being considered. For example, if students know that doorways are usually 2 m high, then students can be asked to compare the length or height of people or objects in relation to the standard height of a doorway.

Most subject areas can contribute significantly to the development of a measurement sense. Whenever a country is being studied in social studies, its size can be compared with the size of other geographical areas familiar to the students. For example, a chart portraying a map of Saskatchewan can be overlaid with an outline of the country of France to demonstrate comparative size. In the physical sciences, where measurement is commonplace but the units are not, teachers can facilitate students' understanding of units such as light years, pascals, joules, newtons, milliamperes and nanometres by providing them with a concrete reference. For example, a dollar bill lying flat on a table exerts a pressure of about 1 Pa.

It is the responsibility of all subject areas to help students to think and estimate with metric units. All measurements and measuring tools seen in school should continue to involve metric units, especially in the elementary and middle grades. As students need considerable practice in converting from one metric measurement unit to another, teachers can provide opportunities for students to convert from cm to mm, and back again.

Space and shape

Although it is important for students to learn the terminology used to describe geometric shapes (i.e. diagonal, perimeter, square and radius), the focus of instruction should be on **the properties of plane and solid objects and how such knowledge can be applied to real-world situations.** Spatial concepts are developed best through kinesthetic experiences. Plane and solid shapes should be available for pupils to handle, measure, and use in building. Students can learn a variety of ways that plane and solid objects can be constructed from simple materials or drawn with conventional instruments. All students can learn to use such drawing instruments as a ruler or compass.

Students can also learn how to read a variety of scale drawings and plans, make reasonably accurate sketches of simple or complex structures, and occasionally construct a full or scale model using a plan or drawing. Such activities can help students learn spatial concepts and relationships, use appropriate terminology, and improve their ability to visualize.

Data analysis and interpretation

Knowing how to read and interpret quantitative information presented in any number of forms is essential for functioning in an information society. At a minimum, students need a facility with the base ten number system and an understanding of how symbols can be used to represent quantities. Emphasis in all subject areas should be on the practical handling of numbers, such as interpreting graphs, using an instructional manual or reading prices. Structured concrete materials - such as base 10 arithmetic blocks, bundling sticks, place value charts and containers, abacuses, money and metric measuring instruments - should be used to develop an understanding of decimal place value relationships.

An important aspect of data analysis is the reading and interpretation of information organized in tables and charts or displayed as graphs. To develop a facility with reading these types of data presentations, it is important that almost all school subjects contain some instruction on reading and using tables, charts and graphs commonly seen in a particular area of study.

One of the most important areas of Numeracy utilized in our technological society is **statistics**. Statistics refers broadly to the collection, analysis and interpretation of numerical data. Because of its importance, students should become familiar

with rudimentary statistical notions; in all school subjects students should be encouraged to critically examine any statistics cited as evidence for an argument or used to express a point of view. It is important that students learn to withhold judgements about any argument based on statistical information until they find out how this information was obtained.

The study of **elementary probability** should emphasize its use in estimating risks, chances, odds and proportions. Students should see how probability is used, as in forecasting weather conditions, in estimating risks to the environment from chemical pollutants, or in determining the chances of winning a lottery. In all subject areas an attempt should be made to help students understand common expressions and uses of probability.[5]

Summary

To summarize the theory and practice of promoting Numeracy:

- **learning in the content areas should promote the ability of students to function effectively in quantitative situations;**
- **students require opportunities to encounter, solve and discuss real-life experiences utilizing quantitative information in all of the Required Areas of Study and other school subjects;**
- **it is important to develop students' intuitive knowledge of mathematical concepts and techniques through practical experiences involving a variety of concrete materials.**

5. See the Practical Resources at the end of this handbook (Appendix A) for a list of publications that suggest real world uses of statistics and probability.

Table 3.1
Numeracy

An overview of **some** of the student and teacher behaviors that might be seen when developing Numeracy.

Teacher Behaviors	Student Behaviors
— introducing and using **concrete materials**	— measuring with **non-standard measurement units** such as hands, feet or pennies — holding objects of varying mass in hands and determining which object feels heavier (or lighter) — pouring liquid into differing containers in order to observe the **properties of volume** — measuring the **concept of time** with handclaps, water drips, ball bounces, pendulum swings or hops — using rulers, metre sticks, cloth and metal tapes, trundle wheels, calipers, micrometers and feeler guages — using pan balances, standard weights, compression scales and a variety of spring balances — using unit squares, graphing paper and transparent grids — using unit cubes, standardized spoons and cups and graduated beakers — using devices such as base 10 blocks, various abacuses, metre sticks, money, place value charts and bundling sticks
— introducing and using **everyday equivalences,** when appropriate e.g. doorways are about 2 m high; packaged butter is 500 g or 0.5 kg; the thickness of a dime is about 1 mm; the distance from Saskatoon to Yorkton is around 300 km; milk cartons are usually 1 or 2 litres in capacity	
— **questioning and discussing strategies** to:	— discussing their strategies by **talking** about their thought processes.
a) develop **everyday equivalences** e.g. "Would a length of 4 metres be higher than the doorway? Does the answer seem sensible in light of this fact?"	
b) explore students' thinking in areas such as problem solving, mental math and estimation (i.e. Discussion strategies are a critical part of teaching mental math because there is no other way for students "to show their work".)	— sharing how they "see" a problem — sharing alternative strategies
c) focus upon the most appropriate means of calculation for particular tasks	— matching **means** of calculating to **purpose** for calculation and complexity of task.

— introducing and using **varied calculation** strategies (i.e. pencil and paper methods, mental calculation, estimation, calculators)

e.g. **mental calculation:**

a) model "shortcut thinking"

b) stress "visual thinking"

c) use concrete materials to suggest new ways of **thinking about** and **visualizing** computation problems.

— practicing and receiving feedback related to progress in **varied mental calculation** techniques

e.g. **estimation:**[6]

a) use real life situations, such as newspaper headlines and articles

— identifying whether numbers used in different real life situations (such as newspaper headlines or articles) appear to be exact amounts or estimates, and **discussing** the efficiency of one over the other (in a **particular** situation)

b) emphasize the **language of estimation** (e.g. about, close to, just about, a little less than, somewhere between)

— accepting legitimacy of estimation

c) accept a **variety of answers within a reasonable range**

— demonstrating knowledge of what an estimate is

d) emphasize estimation **regularly**

— sensing when it is **appropriate** to estimate

e) present situations in which students can **analyze what type of estimate is needed**

— recognizing **how close or precise** an estimate is required in a given situation

f) present examples showing **different approaches** to the same situation

— selecting **appropriate estimation strategies**

g) use **oral work and group discussion**

— **using benchmarks** (non-standard units that are familiar objects or events) as referents in order to estimate (e.g. the library is about as far as the park)

— recognizing whether a computed answer is **sensible**

— discussing **how** they obtain estimates in order to help others gain new insights

— **constructing/interpreting quantitative information by:**[7]

a) use of discussion strategies

b) use of activities that

i) reflect **everyday life**
ii) draw on **students' interests**
iii) initially involve readily obtainable data

c) use of calculators can facilitate working with cumbersome real data

— examining assumptions underlying a set of statistical **data** before interpreting results

— discussing basis for statistical data (e.g. who is included in the sample? What does the term unemployed mean and how can it be measured? How does one gather data?)

— **collecting and graphing** of statistical information (e.g. weather forecasting)

— discussing **probability** and **accuracy** and **significance** of predictions

— exploring **patterns** hidden in data

— questioning **relevance and accuracy of inferences**

— understanding role of sample size and sampling methods

6. See Schoen and Sweng (1986), NCTM Yearbook, for further suggestions related to estimation.
7. See Schulte and Smart (1981), NCTM Yearbook, for further suggestions related to statistics and probability.

Chapter IV: Critical and Creative Thinking[1]

The **goal** of incorporating **critical and creative thinking processes** into Saskatchewan's K-12 curricula is to develop individuals who value knowledge, learning and the creative process, who can and will think for themselves, yet recognize the limits of individual reflection and the need to contribute to and build upon mutual understandings of social situations. What is desired are students who have purposes for learning, know how and when to question, who recognize when more information is needed and the type of knowledge which is required, know how to find and organize information, and who can generate and evaluate a number of alternatives to human problems.

Definition

Critical and Creative Thinking can be described as qualities of good thinking processes and as types of thinking. **Creative thinking is generally considered to be involved with the creation or generation of ideas, processes, experiences or objects; critical thinking is concerned with their evaluation.**

Critical and creative thinking are interrelated and complementary aspects of thinking. Almost all of the thinking which we undertake contains some critical and some creative aspects. For example, when we try to solve real life problems we move back and forth several times between creative and critical reflection[2] as we develop solutions or weigh the consequences of any one solution. It is important, therefore, that any attempts to improve thinking abilities pay attention to both critical and creative aspects of thinking.

Critical and creative thinking processes are combinations of abilities, knowledge, values, attitudes, skills and processes. See Figure 4.1 for a diagrammatic overview of the components which contribute to critical and creative thought. While the **knowledge** base required for critical and creative reflection varies from subject to subject, the underlying **values** and **attitudes** remain constant across school subjects. Although skills and processes are somewhat dependent upon specific subject matter for their form, these same values and attitudes are required in all subjects for their execution. It is also important to note that the content of each category is descriptive of the area but not a final or all inclusive list. Educators are encouraged to evaluate these lists and to generate others as they become more familiar with incorporating critical and creative thinking into their teaching.

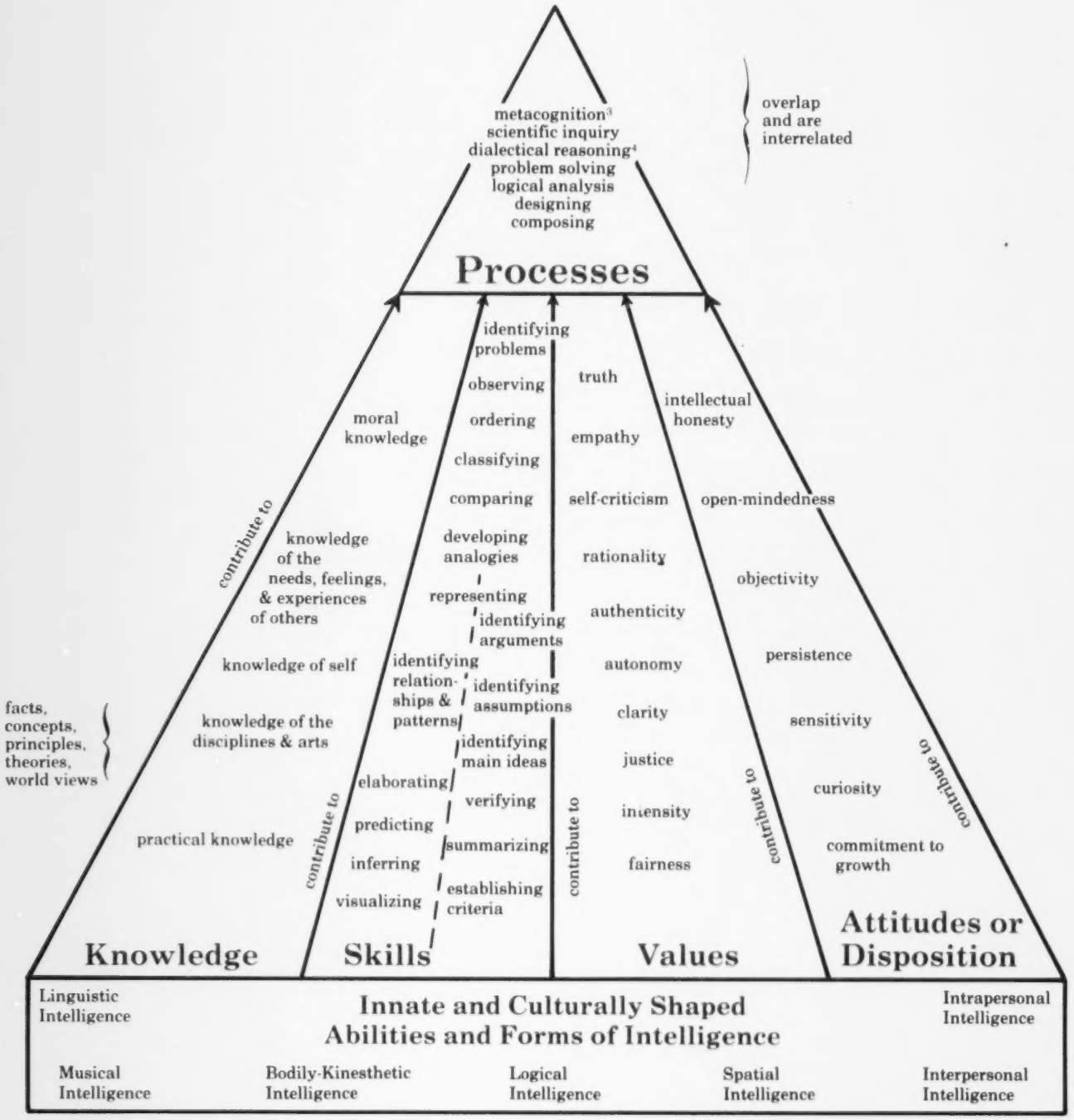
Building upon the analysis displayed in Figure 4.1, a teacher's role could be described as one of structuring activities, assignments and lessons which incorporate all of these aspects of critical and creative thinking into the subjects which they teach. Teachers would attempt to do this in ways which build upon their students' innate abilities, interests, experiences and background knowledge.

Critical and creative thinking contribute to achieving such crucial goals for education in Saskatchewan as developing students who work towards the creation of greater social justice, exercise the right to dissent responsibly, and act in accordance with an ethical framework which reflects qualities such as honesty, integrity and compassion (Saskatchewan Goals of Education, 1984). A final aspect of how Critical and Creative Thinking is defined by Saskatchewan Education is related to these goals and can be stated as the intention to develop "strong sense" critical and creative thinkers.

1. The work of Sandra Klenz (*Creative and Critical Thinking*, Saskatchewan Education, 1987) has been used extensively in shaping the discussion of this Common Essential Learning.
2. Reflection and thinking are being used interchangeably in this chapter.

Figure 4.1

Critical and Creative Thinking: Some Key Elements



3. Metacognition refers to knowledge of one's own thinking processes and products or anything related to them. It is "thinking about one's own thinking."
4. Dialectical reasoning involves metacognition and also includes thinking about the reasoning, motives and arguments of others. It includes seeing all sides of a question and analyzing the strengths and weaknesses of opposing points of view.

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Paul (1987) distinguishes between "weak sense" and "strong sense" critical thinking in the following way. People who have the abilities necessary for undertaking quality critical and creative thought but use them only to their own advantage are critical and creative thinkers in the weak sense. **Strong sense critical and creative thinkers, however, are committed to using their abilities to seek out the most accurate and fair positions regardless of or in spite of their own particular interests or desires.** Such thinking takes into account the needs, viewpoints and arguments of others and is built upon analysis of one's own motives.

Rationale

The importance of having students develop good critical and creative thinking abilities has to do with the foundations needed for a democracy and with the tools needed for independent and life-long learning. A democracy is only as strong as its citizens are informed, capable of, and willing to engage in critical and creative reflection. Critical thought is necessary for analyzing arguments and for rational decision making, while creative thinking is necessary in order to develop alternatives to ways of life not considered upon reflection to be desirable. Students also need to develop these thinking abilities in order to move their learning beyond memorization or passive acceptance, to understanding and the commitment to persevere until clarity and insight are achieved. Without a commitment to critical and creative thinking the values of rationality, truth and justice achieve little substance in the classroom.

Given the above purposes for developing students' critical and creative thinking abilities, it is important to examine teaching methods or means of instruction in terms of their consistency with these purposes. While the last decade saw the development of many commercial thinking programs designed to teach thinking as generic skills which could be developed in isolation from school subjects and from analyses of underlying values and beliefs, most researchers today (see for example, Klenz, 1987; Marzona, Brandt, Hughes, Jones, Presseisen, Rankin and Suhor, 1988) argue that critical and creative thinking processes are more than simply technical skills.

A technical skill is one which can be taught in the same way across a number of contexts without involving an individual's basic feelings, beliefs or motives in any significant way. A technical skill, then, can be learned in the same manner regardless of whether one is a fair-minded or compassionate individual or whether one has foundational knowledge in any particular school subject. Critical and creative thinking are not these types of skills. Rather, developing these thinking abilities involves will or desire on the part of the thinker to go beyond what is given and to make an attempt to understand the self and question the motives of others. Such thinking is highly dependent upon human purpose. **Treating critical and creative reflection solely as technical skills is not consistent with the purposes for which they are being developed in Saskatchewan schools.**

In addition, it is important to recognize that **critical and creative thinking takes different forms in different disciplines or arts** and that critical and creative reflection do not develop in a vacuum. Every occasion of thought requires some content to reflect upon. Thought is shaped by content - by the facts, concepts, principles and theories of various disciplines or fields and by one's experiences and observations.

While critical and creative thinking may contain some common elements, they also take unique forms in unique areas of study. For example, critical thinking in mathematics does not necessarily involve the same mixture of knowledge, skills and processes as critical thinking in social studies or the arts. **The criteria for good critical or creative thought in an area of knowledge depends upon the methods developed in that area for establishing the truth of its claims.** This implies, then, that being able to think critically about literature is no guarantee that one will also be capable of critical and creative reflection using the concepts and principles of algebra as subject matter. While the values which move people to attempt such reflection remain constant, the knowledge base required does not. **Part of the teacher's role in fostering critical and creative thinking abilities is that of building students' understanding of the concepts, skills and processes of the various disciplines and fields and of their methods for constructing and evaluating knowledge.** Teachers need curricula and instructional methods which support inquiry into methods for knowledge construction, such as how scientists "do" science or how historians establish historical facts.

In **summarizing** the purposes and definition of critical and creative reflection, it is important to understand the relationship between **why** one would undertake such reflection and **how** one would best go about it. Methods follow from purpose. This understanding may be developed further through an analysis of the teacher's role in assisting students to become critical and creative thinkers.

The Teacher's Role

The role of the teacher in helping to improve students' critical and creative thinking abilities includes examining the personal qualities required of teachers by such a goal and the classroom climate and teaching practices which best support it.

Teachers as models

Discussion of the teacher's role in fostering critical and creative thinking must begin from a recognition of the teacher as a person whose unique character, interests and desires can not be separated out from the idea of the teacher's role. Good teachers are doing more when they teach than acting according to prescribed roles. Their desire to nurture a love for learning, to help students recognize and act upon their capabilities, and to establish a classroom climate which is based upon mutual regard and respect gives their teaching purpose and meaning beyond any technical description of the teacher's role. What is required is that teachers be authentic individuals who are striving to improve their practice through the use of critical and creative thought. Acting upon their belief in the importance of critical and creative reflection, teachers would attempt to:[5]

- analyze their own thinking processes and classroom practices and provide reasons for what they do;
- be open-minded, encouraging students to follow their own thinking and not simply repeat what the teacher has said;
- change their own positions when the evidence warrants, being willing to admit a mistake;
- consistently provide opportunities for students to select activities and assignments from a range of appropriate choices;
- exhibit genuine interest, curiosity and commitment to learning;
- undertake the organization and preparation required to achieve learning goals;
- seek imaginative, appropriate and ethical solutions to problems;
- be sensitive to others' feelings, level of knowledge and degree of sophistication;
- show sensitivity to the physical elements which contribute to a stimulating learning environment through the physical arrangements and displays they provide or facilitate;
- allow for student participation in rule setting and decision making related to all aspects of learning, including assessment and evaluation.

Developing a climate conducive to critical and creative reflection.

An integral part of teaching methodologies designed to foster critical and creative reflection is the type of classroom environment which the teacher helps to create. The type of climate which appears to be most desirable (Klenz, 1987; Marzano et al., 1988; and Paul, 1985) is one which fosters psychological safety and intellectual freedom within a structure where individuals respect one another as persons of unconditional worth.

Teachers can move towards making their classrooms more thoughtful places by making judgements and decisions from a base of empathy and understanding, by valuing originality and authenticity, and by using differences of opinion as teaching situations which invite thoughtful analyses. More specific activities and strategies for the improvement of thinking abilities will also be proposed, with the qualification that the best ways to foster critical and creative thinking will continue to be developed by reflective practitioners as they come to know their students. What is needed are teachers who engage their students in meaningful activities - ones which incorporate students' unique interests, abilities, backgrounds and community needs. **The ideas presented here are only intended as starting points for further reflection, and like all good ideas will be improved by critically appraising their application to individual situations.**

Teachers can foster critical and creative thinking within the various school subjects by:[6]

- Using the vocabulary of critical thinking themselves. For example, asking questions such as: "What can you **infer** about the effects of this action from the statements given? What can you **conclude** about the person who took this picture from the evidence contained in the picture? Is honesty a **necessary condition** of friendship?"
- Involving students in role plays or simulations of historical events where people held conflicting views. For example, the constitutional debate between the federal government, the governments of the provinces, and the leaders of The First Nations, the Metis and non-status Indians.

5. This list was developed through adapting and expanding upon one contained in *Dimensions of Thinking: A Framework for Curriculum and Instruction*, 1988. ASCD, p. 31.
6. This list was developed through adapting and expanding upon one contained in *Dimensions of Thinking: A Framework for Curriculum and Instruction*, 1988. ASCD, p. 31.

- Organizing for "structured controversy." That is, involving students in discussions and debates which tackle more than one side of an issue and require students to back arguments with evidence and reference to consequences.
- Being alert for and encouraging students to notice where material presented in texts, films and other communications over-simplify or distort reality as students understand it.
- Encouraging students to use qualifiers and recognize contradictions.
- Supplementing regular textbooks with additional curriculum materials (including non-print forms) which could provide local, regional or provincial applications, appeal to more than one of the senses, offer alternative ways of knowing, and/or provide a wider variety of perspectives on the subject matter.
- Having students attend community meetings, watch television programs or read newspaper articles which express different viewpoints. Following this by an analysis of the relative strengths and weaknesses of the arguments, including analysis of the possible motives or human purposes underlying the viewpoints.
- Having students attempt to solve real life problems where there is the possibility of more than one adequate solution and where several different types of information are required.
- Exploring with students the methods used to develop knowledge in a particular discipline or field.
- Asking students questions with multiple answers or several equally correct answers.
- Requiring students to defend their assertions with reasons. For example, when students answer a question the teacher would follow the students' answers, whenever appropriate, with a further question which asks the students why they believe this version or think their answers are reasonable, plausible or accurate.
- Having students analyze the content of popular media - music, movies or TV - for the accuracy and completeness of its portrayals and the consistency of the reality presented with life as they know it. For example, exploring the contradictions between the existence of poverty and commercials which portray the acquisition of material possessions as being largely a matter of choice between competing brands rather than requiring that one have the money to afford them.
- Having students analyze the content of popular media using standards which compare the media's portrayal of human behavior with ideals, such as treating people with respect and tolerance and refraining from stereotypical, sexist or racist views. Inquiring into media's portrayal of the consequences of human actions.
- Requiring students to analyze objects and artifacts, either man-made or in the natural environment, from a design perspective which examines their purpose, structure, model cases and the criteria for their evaluation (see Perkins, 1984).
- Using, and encouraging students to use, analogies and metaphors in descriptions, comparisons and attempts to understand new concepts, ideas, principles or theories.

Practices such as these do not need to be restricted to middle years or secondary students. Critical and creative reflection can be improved beginning in the early grades when teachers understand these thinking processes themselves. Before students can analyze arguments, tease out the assumptions contained in them, or recognize possible motives which shape people's views or restrict their objectivity, they must have a sense of themselves and of others as persons of worth. This sense is built from an understanding of human feelings and of how individuals' behaviour affects the persons around them. Kindergarten teachers begin to develop such understandings from the first day of school, through activities which engage students' emotions while helping them acquire a language to express these emotions. It is also important for teachers of young children to offer support to students in solving their own social problems and conflicts, but not to impose solutions upon them. Critical and creative thinking begins when a child is expected to confront in their own thinking, the **reasons** for treating other people with respect and the **ways** in which one can do so.

Quality of thought also improves through direct encounter with reality - with the concrete and with the natural materials which can be provided in an expanded school environment. An important aspect of the teacher's role in providing students with concrete materials and real life experiences is to ask critical questions which foster student reflection about these materials and experiences.

Some general guidelines for teachers, which apply to developing critical and creative capacities in students of all ages, would be to:

- choose real objects and experiences over workbooks and textbooks in developing understanding whenever possible. For example, when studying ponds and pond life, a trip to the pond is important and more appropriate than the use of books or films alone.
- consistently allow for students' input into establishing the criteria for the evaluation of classroom activities, assignments and behaviors.

- choose to display students' work over commercially prepared displays. For example, while commercial alphabet displays are readily available, only students can create an alphabet which will be personally meaningful to them and contain their own experiences and categories.
- consistently offer and encourage students to seek alternative ways of responding to structured art activities, fulfilling learning requirements, or completing a craft, project or assignment. While 2 + 2 should always equal 4, there are at least 100 ways to make a paper mouse.

Perhaps the most important aspect in developing a climate conducive to critical and creative thinking is to increase students' will or motivation to behave reflectively. While there are many ways to learn and to know, the knowledge retained by students is that knowledge which they find relevant to their daily lives or which can be integrated into larger systems of knowledge. This does not mean that learning should always be easy or that all knowledge should have immediate relevance. It also is not intended to imply that memorization and drill are necessarily inappropriate or meaningless activities. Rather, the suggestion is that students will voluntarily exercise their own willpower and persevere at difficult learning tasks (including memorization when necessary), if they see the learning task as personally meaningful. **For educators, this means portraying knowledge as valuable in itself and as a means to important human ends.** Thus, the knowledge which students encounter in schools must not be presented solely as isolated or discrete elements, but rather should be explored as parts of meaningful wholes. Knowledge must be examined in terms of its relationship to other knowledge and to students' experiences and understandings. Teaching which encourages students to reflect upon and build these relationships supports critical and creative thinking.

Finally, because teacher-questioning is such an important aspect in the development of critical and creative thinking processes, a brief overview of types of critical questions would be useful. The following types of questions can be used to stimulate individual reflection, process writing, and small or large group discussion in a subject area.[7]

Types of Critical Questions

1. Questions of clarification:
   Examples — Could you give me an example?
   — Is your basic point ____ or ____?
2. Questions that probe assumptions:
   Examples — You seem to be assuming ____.
   — How would you justify taking this for granted?
   — Is this always the case?
3. Questions that probe reasons and evidence:
   Examples — How could we go about finding out whether that is true?
   — Is there reason to doubt that evidence?
4. Questions about viewpoints or perspectives:
   Examples — How would other groups or types of people respond? Why? What would influence them?
   — How would people who disagree with this viewpoint argue their case?
5. Questions that probe implications and consequences:
   Examples — What effect would that have?
   — If this and this are the case, then what else must also be true?

7. Adapted from Paul, Binker, Jensen & Kreklau's (1987) *Critical Thinking Handbook: 4th - 6th Grades*. For a fuller description of questioning and types of questions which encourage critical reflection, see their discussion of Socratic questioning.

6. Questions about the question:
   Examples — To answer this question, what questions would we have to answer first?
   — Is this the same issue as ____?

While these types of questions may be more the responsibility of the teacher in the beginning of the school year, with consistent modelling and encouragement students should increasingly take responsibility for asking these questions of themselves and their peers.

Summary

In summarizing the teacher's role in developing critical and creative thought processes, teachers need to:

- **understand the purposes underlying this goal;**
- **believe in its potential benefits to students; and**
- **become increasingly reflective about their own practice in order to build the values, skills, knowledge and processes of critical and creative thinking into the subjects which they teach.**

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Chapter V: Technological Literacy[1]

The **goal** of incorporating **Technological Literacy** into Saskatchewan's K-12 curricula is to develop individuals who understand how technology and society influence one another and who are able to use this knowledge in their every day decision making. **What is desired are students who are able to analyze the technological influences on their lives and see themselves as having roles and responsibilities in shaping public policy related to technological change.**

Definition

Technological Literacy can be described as the intellectual processes, abilities and dispositions needed for students to understand the link between technology, themselves and society in general. Technological Literacy is concerned with developing students' awareness of how technology is related to the broader social system, and how technological systems cannot be fully separated from the political, cultural and economic frameworks which shape them. In order to achieve an informed, balanced and comprehensive **analysis of the technological influences on their lives and then be able to act on the basis of their analysis,** students require certain levels of knowledge, skills and abilities. These include:

- understanding that technology includes hardware, know-how, cultural needs and desires, and economic and political decision making;
- understanding how **technology shapes and is shaped by society;**
- understanding that technological issues involve conflicting **assumptions, interpretations and options;**
- having the necessary **data collection and decision making skills** to make intelligent choices;
- having the ability and desire to take responsible action on **social issues.**

A Technologically literate person is someone who critically examines and questions technological progress and innovation. To be critical about technology means to have "the intellectual skills to analyze the pros and cons of **any** technological development, to examine its potential benefits, its potential costs, and to perceive the underlying political and social forces driving the development" (Fleming, 1987, p. 6). Decisions about the creation and use of new technology involve human, social and environmental issues which place constraints and limits on the solutions. Values also influence intellectual processes, since anything that involves choice also involves consideration of whose values are shaping a particular technological development. The capacity to make **critical judgements** involving technology increases the ability of students (as citizens) to use such knowledge to shape and influence their environment.

Rationale

Many changes have occurred in society as a result of advances in science and technology. Some of the changes have been good; other changes have entailed risks that were either not known or only dimly perceived. Science and technology touch the lives of all people in basic ways every day, affecting the manner in which they obtain food, transportation, clothing and housing. As **science and technology** play increasingly vital roles in peoples' lives, it is important to develop a basic understanding of both forces in this technologically-rich society.

Science

Science is **a process of discovery**. It is a set of ongoing procedures including hypothesis testing, observing and synthesizing information, in order to better understand the world. Scientific knowledge is the result of humans reaching a *consensus*[2] about some aspect of the physical world. That is, the acceptance of data depends upon psychological and social factors, such as the beliefs and values of the scientist and of the society, as well as agreements related to methods for acquiring scientific knowledge. This reflects the nature of both scientific data (which tend to be theory-laden) and science as a human activity (with its personal and social aspects).

1. In framing the discussion of Technological Literacy in this chapter, the work of Reg Fleming (*Technological Literacy*, Saskatchewan Education, 1987) has been used extensively.
2. See Aikenhead (1987) "A module for teaching scientific decision making" for further discussion related to scientific consensus-making.

The findings of scientific experiments result from the interaction of scientists, scientific knowledge and the community. What distinguishes science from tchnology is that its role is to extend and modify knowledge - to change knowledge rather than to preserve it. This role arises from an interest in acquiring knowledge for its own worth and not as a means to other ends.

It is critical that students appreciate the need for scientific knowledge above and beyond technical applications. In order to assess the value of fundamental research (as opposed to applied research) it is necessary to have an understanding of how scientists proceed with their work.

Technology

Technology can be defined through the following understandings:

1) Technology is more than the "hardware" or the non-natural objects manufactured by humans.
2) Technology includes **"know-how"**, i.e., having the information, skills and procedures necessary to design, produce or use technology. Such "know-how" is not sufficient in itself.
3) Technology is the **process of manufacturing** . the hardware, which includes the **economic, social and political** environments that make this manufacture possible. (For example, an important part of understanding a technological development is understanding **how** and, as a consequence, **why** it is funded.)
4) Technology is the **use of hardware and people in order to extend human capabilities.** (For example, the use of automobiles leads to a system of roads, gas stations and driving laws. It is this combined system that extends the human capability of moving about.)
5) Technology is **an ordered, rational effort to solve definable problems.**

Technology enriches and eases daily life, but can carry with it unanticipated side effects. It is important to consider the **benefits compared with the costs** - in terms of resources, value and money--before and during the development of a technology. There is always a degree of risk involved, because of the difficulty in predicting all the effects of a particular technological development. As technology is at the heart of many of the critical issues facing today's society, students need to develop an understanding of both the benefits and the risks inherent in any given technological innovation. In order to make intelligent decisions on technological issues, it is important for students to **understand how technology and society influence each other and then be able to use this knowledge to shape public policy in a democracy.**

Technology and society

An understanding of how technology shapes and is shaped by society is based on two principles. First, technology is **an agent of social change**. Technological systems have produced great increases in the speed of communication, made mass production possible, and reduced physical labour for human beings. Technology has also provided an abundance of products and services; this requires individuals to make wise consumer decisions. Second, **societies influence the course of technological development.** Social, historical and cultural factors determine if, and how, a technology is used.

More than ever before, students are immersed in an environment shaped by human technology. Citizens' responsibilities in a technological age are defined as the exercising of democratic rights on issues that affect the direction to be taken by society and its technological developments. Becoming technologically literate means coming to grips with the problems of living in, and exerting influence upon, the constructed world.

Democracy

In a democracy, it is believed that people of differing abilities and roles can communicate to create answers to problems of living; it is also felt that citizens can have some influence upon which technologies are advanced or restrained and how this process occurs.

As citizens become better informed, they can begin to exert some measure of control over technological change. Public policy agendas at the national and provincial levels include issues and problems that require a level of technological literacy. For example, people might need to assess how a technological development would affect their personal health.

The active, informed and effective participation of citizens in the governing process requires **information** about matters and issues, **understanding** of the workings of political systems and of the processes of participation, rational **decisions** about those matters and issues, and finally, **action** based on those decisions.

Further, it is critical to understand who makes decisions about particular technological innovations and from what bias these decisions are made. Value claims are implicit in any

positions regarding technological innovation and development. Therefore, critical analysis of these positions - including an examination of both the underlying values and the factual information provided by experts - is necessary in order to create citizens who are informed decision makers.[3]

Summary

In order for students to live effectively in a technologically-sophisticated society, they need critical understandings which include:

- **understanding of science as a process of discovery and consensus-making;**
- **understanding of technology with its inherent risks and benefits;**
- **understanding of how technology shapes and is shaped by society;**
- **understanding of the relationship between technological decisions and human values;**
- **understanding of the roles and responsibilities in shaping public policy related to technological change.**

It should be noted that not all students may be able to integrate these critical understandings to the same degree. Some students with special needs may not be capable of reaching a level where they can analyze issues. These students may be more involved with the "know-how" aspect of technology, and may need to be assisted in the development of abilities to use technology in order to enhance the quality of their lives.

The Teacher's Role

The role of the teacher in developing technologically literate students includes:

- building increased awareness, knowledge and understanding about technological developments of interest to students and to society as a whole through **a contemporary view of technology** (as presented in Figure 5.1);
- fostering **critical thinking and decision making,** based on evidence and on moral principles such as respect for persons or respect for the environment;
- providing opportunities for students' active involvement in local, regional and national issues.

A contemporary view of technology

This perspective requires that technological developments be **related to students' lives** and to the society in which they live. For certain disabled students, technology can be the key to greater independence. For example, a personal computer with voice output can be used by students unable to speak or by blind students as a note-taking device and word processor. The use of adaptive devices by students with challenging needs can unlock the doors to communication, to participation in activities, to independence and to learning. Through the use of appropriate strategies, materials and experiences students with special needs can be assisted in using technology to enhance their daily living, safety and health, leisure and recreation, and decision making. Such abilities will enable these students to function as full members of society.

One area in which students can examine the impact of technology on their lives, is the development of computer technology. Computers are becoming more familiar in the school system at all levels. Computer literacy - as one aspect of technological literacy - requires more than programming skills. A curriculum for computer literacy should reflect a blend of the technical, cultural and organizational aspects of computer technology; it should also familiarize students with

3. See Fullinwider (1987) for further discussion related to technological literacy in a democracy.

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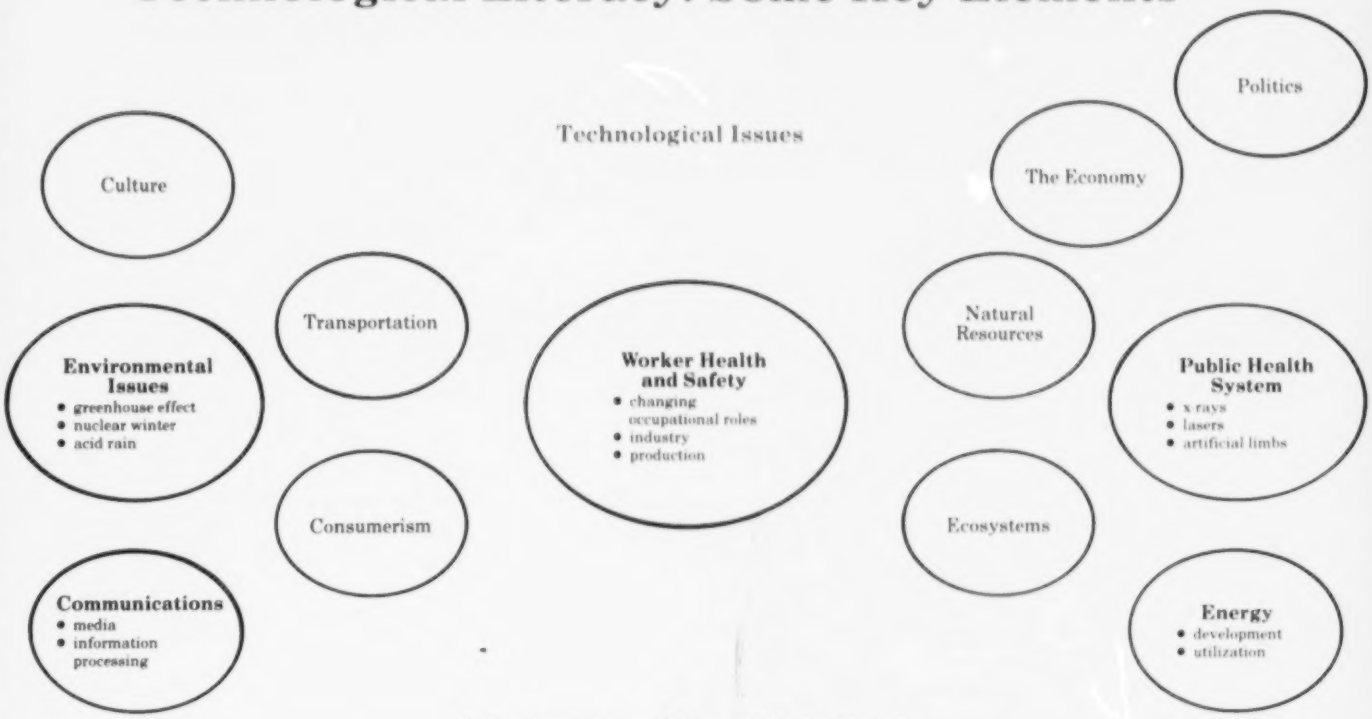
Figure 5.1
Technological Literacy: Some Key Elements



4. **A contemporary view of technology** includes both the more explicit concepts (contained by the solid lines in the lower portion of the inverted triangle) and the more implicit concepts (outlined with dotted lines in the expanded upper portion of this triangle). The intellectual processes, such as debating or problem solving, can be used to develop Technological Literacy. **Some** of the technological issues and areas that can be explored with this development are also illustrated.

the public policy issues posed by information technologies. With access to vast amounts of information through databases, students need to understand the importance of distinguishing between **what** information is available and the **purposes** for which that information can be used.

In order to deepen students' understandings about the effects of technological developments on their lives, it is important to relate these developments to issues and interests that are real to students. By linking subject matter with everyday life and developments in society, students become involved in authentic and understandable experiences related to technology. In the earlier grades, technology can be looked at in terms of smaller and more local issues. For example, a unit on magnets could provide students with the opportunity to brainstorm about how their day would change if there were no magnets (for example, fridge doors wouldn't close). A subsequent discussion of what life would be like without magnets would help students consider the impact of this technological development on society as a whole (for example, the absence of large industrial magnets would create more jobs for people).

It is important to have students draw relationships in their studies to larger world issues and to discuss both the positive and negative aspects of technology. This provides an accurate view of the role that technology plays in both meeting human needs and creating human problems.

Anderson (cited in Marker, 1987) has developed a guide for analyzing technological innovations that helps students understand the interrelationships between technology and social change, as well as the trade-offs and unexpected side effects that result from technology. An adapted version of the list follows.

1. List all the effects of the technological innovation.
2. Categorize the effects according to whether they were planned or unplanned by those who introduced or eagerly adopted the innovation.
3. Indicate which effects were felt only in a local area, or at a regional, national or global level.
4. Divide the effects on the list into "positive" (benefiting people in general) and "negative" (those which were harmful) and "both" (having both positive and negative aspects).
5. Indicate which subgroups in society:
   a) benefited most from the innovation.
   b) suffered the majority of the burdens of the negative effects. Where applicable, list 2 reasons for the inequitable distribution of benefit and burden.
6. List what actions have been or are being taken to alleviate the burdens.

Just as technological developments change societies, teachers can help students understand that societies also influence the course of technological developments. Understanding technology requires a consideration of the social forces brought to bear on those who make decisions about a technological innovation. The direction of technological development is often guided by the needs of managers, who may not be trained in the technical aspects of technology. Statements presented by developers, in support of their position for a particular technological innovation, require critical examination. The values that underlie such statements also need to be considered.[5] Students who are acquainted with the values that underlie technological decisions are better able to participate in the shaping of public policy.

5. See Devore (1986) and Gray (1987) for further discussion related to valuing.

Critical thinking and decision making

The interactions between technology and society sometimes lead to issues that can only be resolved by examining all sides of the question, as well as the beliefs, values and alternate solutions associated with each side. It is critical, then, to develop issue investigation and action strategies which students can apply to the issues they will face as citizens. Teachers can develop the necessary knowledge and skills within the Required Areas of Study through:

- involving students in locating information both from print and non-print sources, structuring relevant information and critically comparing information from different sources;
- modelling and encouraging the critical evaluation of data/information;
- providing class time for student debate and analysis;
- giving students time to reflect verbally and in writing;
- structuring questioning and discussion (related to technological developments) so that implicit judgements based on assumptions and values become explicit;
- having students make comparisons of differing views by charting the differences and similarities, and then drawing conclusions;
- having students list the advantages and disadvantages of each side of a technological issue;
- helping students develop a broad perspective on the role that technology has played in the evolution of civilizations (both past and present);
- developing in students good habits of inquiry such as respect for evidence, care in drawing conclusions, curiosity and a healthy skepticism;
- encouraging student inquiry with an emphasis on how the student reached his or her solutions;
- exploring other cultures to understand the diversity of ways in which humans relate to their environment and to technology;
- modelling and encouraging the use of problem solving and decision making strategies.[6]

An example of the last point is Patrick and Remy's "decision tree" (cited in Marker, 1987 and White, 1987). This strategy can be a useful aid in developing alternatives and reaching a rational decision. The 4 basic elements are:

i) **discover** the need for a decision;
ii) **explore** the values and goals relevant to the decision opportunity;
iii) **develop** alternative courses of action;
iv) **predict** likely consequences (positive and negative) of alternative courses of action.

Most skills are learned very gradually. For instance, "critically comparing information from different sources" cannot be learned quickly. It is important to widen students' concept of learning so that they **recognize gradual learning as real learning.** Assessment techniques should include an evaluation of this gradual learning process.

Active involvement

Responsible action related to decision making can be encouraged by:

- introducing decision making strategies and providing opportunities for students to use the strategies in reaching decisions related to technological issues;
- providing students with practice in exercising "control" over situations involving technology at different levels - personal, local, then regional;
- developing students' abilities to take persuasive consumer, legal or political actions in the resolution of issues (e.g. writing letters to newspapers or speaking at public meetings).

Summary

To summarize the theory and practice of promoting Technological Literacy:

- **learning in the content areas should provide a contemporary view of technology related to students' interests so that students have an understanding of the social, economic and political forces which affect technological developments;**
- **it is critical for students to realize that technology both shapes and is shaped by society, and that as citizens, they can be a powerful influence in shaping the course of technological innovations;**
- **it is important that teachers promote the development of critical thinking and decision making and encourage students to act on the basis of their decisions.**

6. See Wales, Nardi and Stager (1986) "Decision Making: New Paradigm for Education"; Ehrenberg, Enrenberg and Durfee (1979) *BASICS: Teaching/Learning Strategies*; and Chance (1986) *Thinking in the Classroom* for some decision making models.

Chapter VI: Personal and Social Values and Skills[1]

The **goal** of this Common Essential Learning is to assist in the development of compassionate and fair-minded persons who can make positive contributions to society as individuals and as members of groups. What is desired are individuals whose actions reflect an educated, rational and empathetic sense of social responsibility. In the classroom, this Common Essential Learning has two related aims: to support students in treating other persons with respect; and, to support students in coming to a better understanding of the personal, moral, social and cultural aspects of school learning.

Definition

Personal and Social Values and Skills is that complex of knowledge, values, attitudes and abilities which contribute to the development of a sound moral character, a sense of community, and competence in responding to the personal, social and cultural aspects of life. This C.E.L. is intended to contribute to an understanding of the rational basis for examining moral questions and the resolution of conflicts between individuals' needs and desires on the one hand, and their responsibilities to others and to the environment on the other. It involves the development of self knowledge and understanding of the feelings, experiences, needs, purposes and rights of oneself and others.

Other Common Essential Learnings contribute to the achievement of this one, particularly Critical and Creative Thinking and Communication. While not all of our students will have the same mental or physical capabilities to reflect upon and communicate their understandings in this area, all students will benefit from a caring environment wherein teachers model respect for all persons.

A basic understanding in this area involves distinguishing between different types of values. For example, one can make a distinction between fundamental moral values and aesthetic, economic or other kinds of relative values. Values within these categories can be held either by individuals or by cultural, social or political groups. Although a democratic society does not establish absolute standards for aesthetic, economic or recreational values, certain fundamental moral values are considered necessary for all citizens to hold. Further, while many personal values might be relative to the needs and interests of the person, fundamental moral values such as truth, rationality and justice are not. The most basic moral value underlying development of this Common Essential Learning is that of respect for persons.[2] By making a claim for fundamental moral values stemming from a respect for persons, a foundation is established which can be used to develop **rational** arguments about actions or issues of concern.

Moral values, which form one reference point for such reasoning, include values such as: truthfulness, compassion, fair-mindedness, justice, respect for the environment, respect for the rights and property of others, and respect for democratic processes (the rights of majorities and minorities).

Rationale

A focus upon Personal and Social Values and Skills is justified through: its contributions to a just society; the preservation and growth of co-operation and harmony within and between social and cultural groups; self knowledge; and a fuller understanding of the personal and social aspects of school knowledge. Development of the understandings and abilities of this C.E.L. are further justified through the support which they provide to learning situations.

While personal and social values and skills are developed from a rational base, it is important to acknowledge both the affective and cognitive dimensions of human rationality. All learning in schools is acquired in social contexts where, for example, the behavior of an individual can affect the quality of the learning experiences of others.

1. Malikail and Stewart's *Personal and Social Values and Skills* (Saskatchewan Education, 1987) served as a foundational document for the development of this chapter.
2. This is the most basic principle underlying such important documents as the Canadian Charter of Rights and the United Nations Charter of Rights and Freedoms. For the development of a framework for moral reasoning based upon "respect for persons" see Cochrane's "Prolegomena to Moral Education," in Cochrane, Hamm and Kazepides (1979), *The Domain of Moral Education*, pp. 73-88.

The abilities and understandings promoted in this Common Essential Learning contribute to the establishment of an open and caring environment and thus support students' learning and their desire to learn.

Schools are not value-neutral environments: "In transmitting knowledge to children and young people and developing their understanding of the world the school of necessity has to be committed to the value and the ideals of truth" (Malikail and Stewart, 1987, p. 12). Schools within a democratic society must also maintain a commitment to such foundations of a democracy as freedom of speech, equality and fairness in the treatment of persons.

While families and communities will continue to take responsibility for the maintenance of certain societal and cultural values including moral values, this does not exempt schools from their responsibilities in this area. The emphasis desired by Saskatchewan Education is to help students acquire fundamental moral values stemming from respect for persons through rational and humane processes. Thus, the concept of moral relativism (a belief that when dealing with moral issues any decision is as good as any other) is not sanctioned.

The Teacher's Role

It is important to emphasize that discussion of the teacher's role in developing personal and social values and skills builds upon the other chapters in this handbook. While we are not repeating our descriptions of the teacher's role in fostering the abilities contained in the other C.E.L.s, it is important to remember that they apply equally here. This is particularly true of the role for the teacher developed in Critical and Creative Thinking and Independent Learning.

Within what is perhaps the most demanding, challenging and comprehensive of all the responsibilities which educators share, several interrelated areas need to be examined. These areas include: the models of moral reasoning and moral behavior which teachers display in their actions and the classroom structures which they establish; the overall climate of the school; institutional supports for Personal and Social Values and Skills; and the opportunities provided within the Required Areas of Study for developing moral reasoning and promoting self, interpersonal, and cross-cultural understandings.

While the abilities and understandings of this C.E.L. develop gradually and are shaped both by negative and by positive experiences with others, a single compassionate and fair-minded teacher has a powerful and long-lasting positive affect. A good starting point for understanding this potential is to look at teacher behavior that is consistent with respecting persons. Within the larger aim of coming to understand and ground one's behavior in a basic respect for persons, several crucial themes will be explored. These include examining the role of **contradiction, consistency,** and **balance** in developing personal and social values and skills.

Acting with respect for persons

When we respect other people we acknowledge their language, their history and their culture as important aspects of their personal identity. While respect implies causing no harm and supporting the rights of individuals and groups to make decisions about what is in their best interest, it also involves active attempts to do well by others. By conferring the status of persons onto others we oblige them to adopt these same responsibilities. That is, respect must be reciprocal.

In the classroom, teachers model respect for persons in two important and related ways:

1) by treating students, colleagues and parents with respect (showing genuine interest and regard and abstaining from ridicule or abuse);
2) by not accepting a lack of respect from others.

As most classroom teachers can acknowledge, the difficult part of this modelling comes in understanding how to translate these general guidelines into the specific practices demanded by unique classroom situations. The concepts of contradiction, consistency and balance are useful here.

Consistency

Consistency within a respect for persons involves teaching practices like the following:

- Establishing classroom rules and norms for behavior **with** students through open discussion supported by questions such as: "Is this a good rule for all of us to live by?" (The consistency here is one of trusting, that is, respecting students' instincts and desires towards fairness.)
- Being clear about when and in what way students (or one's self) are not acting respectfully towards others, and expecting the behavior to cease. (The consistency here is between having a rule and applying it in the same manner with all people including one's self.)
- Establishing consequences for disrespectful behavior which do not violate the basic rule of acting with respect for persons. (The consistency

here is in treating offenders with respect while demanding improvement. For example, it is inconsistent to shout at students when admonishing them for arguing loudly with each other, or to resort to ridicule and derogatory personal remarks when reprimanding a student for their disrespectful treatment of others.)

- Maintaining expectations that respect for persons is a value shared by all and being worked on by all, through responding to offenses with opening remarks such as: "It is not like you to ..."; or "I realize you did not want things to happen in this way ..."; rather than, "I knew you couldn't be expected to ..."
- Acting on a belief that all persons are capable of growth and improvement in their treatment of others. (The consistency here is one of starting each student's day with a clean slate and not allowing ourselves to become cynical about the intentions or the potential of our students to respond to fair treatment.)
- Having the same expectations for and offering the same support to both sexes. Avoiding sexual stereotyping through language or action and being sensitive to sexual bias in the materials selected for classroom use. Encouraging greater understanding and friendship through grouping practices, seating arrangements, and other practices which do not unnecessarily segregate the sexes.
- **Being clear that sexism, racism, and all forms of bias or discrimination are acts which violate respect for persons.**
- Fostering an understanding that respect for the religious, spiritual or cultural values and beliefs of others is a necessary condition of respect for persons--one which supports the achievement of self esteem and self respect for all. (To be consistent, one would qualify this by saying: this applies so long as those religious or cultural beliefs do not violate the more fundamental moral value of respect for persons or a commitment to truth.)

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Acting in accordance with respect for persons also involves knowing when to treat people **differently** in order to achieve this goal. Respecting students' differing cultural backgrounds requires that teachers become knowledgeable about the behavioral norms of cultures other than their own. (For example, eye contact is not respectful in some cultures.) Ways to behave consistently and respectfully towards students with special needs should also be examined. In some cases it will not be appropriate to expect the same level of understanding and action from all students, but it is important to give all students as much responsibility for their personal, social and moral behavior as their physical and mental capabilities will allow.

Contradiction

When attempting to act in a manner consistent with valuing and respecting persons, contradictions begin to surface which must be dealt with. Schools are social institutions containing people, and people do not always act in accordance with their own moral values and beliefs. While persons in authority are expected to be good role models in this area, at times they are not. This needs to be acknowledged with students in a manner that does not undermine the legitimate authority of teachers, administrators or parents. If disrespectful behavior is glossed over when it belongs to adults but acknowledged when it belongs to students, students may become confused about or mistrustful of the genuineness of our belief in respect for persons and of our commitment to it. They may also doubt our commitment to truth.

We need to develop an understanding of the importance of truth and respect for persons, alongside an understanding of the need for some forms of legitimate authority in social institutions and families. This will enable students to **choose** to behave well, even in those difficult situations where others do not.

The choice would be made from a commitment to the moral values first, and a belief in the communication process second. Where contradictions arise between what people say and how they act, our students need to feel that they can discuss the contradictions, present their viewpoints about injustices or misunderstandings in a respectful manner, and be heard. For adults and students in schools, the important goal here is that of continuously reflecting upon one's own behavior using the standards of truth and respect for persons, and attempting to act in accordance with them. **A belief in the capability and the desire of all persons to improve in their treatment of others is a necessary condition of acting on a respect for persons.**

Balance

Nowhere does the need for constant reflection and the subtlety, the complexity, the artfulness of teaching become more evident than in establishing and maintaining the kind of role model we want to be and the kind of classroom environment we want to achieve. No simple formulas will suffice. The idea of balance is a useful device for weighing the alternatives in individual situations. As educators we need to be sensitive to and constantly adjust the balance between:

- **the rights of the individual and the rights of the group.** (While we need to develop some general rules and procedures for the whole class to follow, on occasion, for good reasons, we need to allow a student to be exempted from rule or established procedure.)
- **freedom and responsibility; variety/choice and ritual/routine.** (Students need to experience both the freedom to experiment and to change their mind and the demands of seeing a difficult task through to completion.)
- **teacher as facilitator with teacher as final authority.** (An important way for teachers to understand this balance is to think of their authority as residing more **in the authority of knowledge and ethical behavior** than in the authority which comes solely from their role. A second way to understand how to achieve this balance is to ask: "Is my authority as decision maker needed in this situation in order to achieve fairness or truth? How will students benefit from my making this decision as compared to their making the decision? Can I help ensure that their decision is a good one by the questions I ask them to consider, rather than prescribing the standards myself?")

Teachers need support from other members of the educational system if they are to fulfil the demands of this role to the extent that they desire. Any examination of teachers' roles is incomplete if it does not acknowledge the reciprocal relationships between teachers' rights and responsibilities and those of administrators, trustees, parents, students and fellow teachers. Thus, the consistencies and balances demanded by the teacher's role and the contradictions which need to be examined should also apply to the school, the school system, and the provincial institutions of education.

Fostering a supportive climate

The more authority over decisions affecting the rights and choices of others that persons have, the more responsibility they have for acting in accordance with a commitment to truth and respect for persons. With power comes the obligation to exercise it wisely, thoughtfully and fairly. Thus, habits of personal reflection upon the rights and needs of others must be part of the daily life of all members of an educational system.

Before one makes a decision or takes action, one should feel confident that all perspectives have been examined, that the history of the situation is understood, and that the intended goals of the action are sound and potentially worthwhile for all students. Self reflection must be supported by knowledge of the situations and lives of those affected by the decision.

The best assurance for educational administrators that the decisions they make will support growth in personal and social values and skills is based on:

- knowledge of self;
- commitment to truth and a basic respect for persons; and,
- a commitment to the processes of co-operation and open communication. Dialogue is as important a tool for moral reasoning outside the classroom as it is within it.

Supporting Personal and Social Values and Skills Across the Curriculum

In developing Personal and Social Values and Skills in all school subjects, three areas require particular examination. These areas are: developing understanding of and experience with moral reasoning; examining the content of curriculum materials in relation to this C.E.L.; and, examining social issues in the classroom.

Moral reasoning

Moral reasoning is concerned with thinking as it relates to the treatment of persons (in the context of their environment) through the use of moral principles derived from the most fundamental principle of respect for persons.[4] Since it is possible to consider these moral principles and their application **objectively**, it is also possible to be rational in our treatment of moral issues and dilemmas.

Although the principle of respect for persons should be the foundation for one's general treatment of oneself and others, the very general nature of this principle makes it a difficult one to apply in concrete situations. Therefore, mediating principles are needed. These mediating principles are logical extensions of the most fundamental moral principle of respect for persons. Examples of such mediating principles would be the commitment to: transmit and promote that which is true; treat all persons equally unless there are relevant differences; maximize another's freedom; and, consider the rights and needs of persons. These principles can be further translated into substantive values which provide rules of conduct. For example, one can derive rules regarding discrimination according to sex or race from the principle of equality. Similarly, since respect for persons is developed within the human context and humans depend upon their physical environment for survival, respect for the environment can also be considered a mediating principle.

4. The account of moral reasoning in this section draws heavily on Cochrane's (1979) analysis. This work provides a comprehensive framework for moral reasoning. While Cochrane does not include "respect for the environment," we consider it to be an important addition.

The process of moral reasoning involves critical reflection upon **how** to translate the fundamental moral obligation of respect for persons in specific situations. This requires that teachers, together with their students, use mediating principles, moral rules and moral values to arrive at moral arguments. This process involves substantive knowledge, fact-finding and open dialogue. Such dialogue should be developed by persons committed to the employment of strong sense critical thinking.

Examining curriculum content

Curriculum development in all subject areas needs to be concerned that the material presented to students is non-sexist and non-racist. As all materials presented for study will not be totally free of bias, teachers should help students examine materials for the biases that they may contain and the possible effects such biases produce. In studies of individuals in science, the arts, social studies, health or literature, students should be exposed to a balance of males and females from differing cultural backgrounds, in both historical and contemporary settings. "Students should come to see that greatness and goodness have found, and can find expression among men and women in different cultures and races" (Malikail and Stewart, (1987), p. 55). The study of literature and the media can contribute to a heightened awareness of stereotypes, an analysis of why they are used and a better understanding of the ways in which biased presentations affect minority groups. In social studies, developing understanding of the relationships between history, climate, resources and cultural patterns can lead to a better understanding of persons from different cultural backgrounds and religious groups.[5]

The use of quality children's literature in language arts and drama can provide elementary students with opportunities to learn about human feelings and about other cultures. Middle years' students can begin to explore how values influence behavior through the narratives of, for example, Louis Riel or Mother Theresa. Secondary students can move from these particular illustrations to discuss understandings such as: whether a character in history, drama or a novel acted in a morally correct way; whether an individual challenged the prevailing moral codes, and why; or whether there were conflicting moral values in the situation being studied. **Throughout their school years and in all their school subjects, material about people should become an important source for thinking about human needs and human rights and how these can be reflected through acting upon a respect for persons.**

Examining social issues in the classroom

The demand that school curricula be relevant and applicable to the challenges of modern life involves educators face to face with the social issues of their time and place. Social issues surface through the content of school curricula in the Required Areas of Study and through the content of students' daily lives - their own real experiences and their exposure to the media.

When such important social issues as racial prejudice or poverty are explored through the themes and concepts of units in social studies, history or health education curricula, they are clearly part of a teacher's responsibilities. The nature of that responsibility is not always clear, however, - particularly when instruction shifts from the prescribed textbook or film to classroom discussion. When a social issue is the focus of study, teachers need to consider how to ensure that treatment of the issue is comprehensive and fair, and also how to avoid moral relativism without stifling student reflection upon perspectives which violate fundamental moral values.

Curriculum decision making related to the treatment of social issues in the classroom can be strengthened by reflecting upon the following guidelines:

- study of social issues should be incorporated into existing curricula and studied as a means of integrating important knowledge, values and abilities rather than in isolation from the content of school subjects.
- study of social issues should strengthen students' understanding of the need for a sound knowledge base in the disciplines or fields related to the issue. Students should develop a greater respect for factual knowledge - its uses and limitations.
- study of social issues should strengthen students' abilities to understand the rights, feelings and viewpoints of others and strengthen their knowledge of themselves. Through collaboration, co-operative research and problem solving, and engagement in meaningful dialogue, respect for others is fostered.

5. See Sawyer and Green's (1984) *The NESA Activities Handbook for Native and Multicultural Classrooms* for activities which examine cultural differences.

- study of social issues should strengthen students' reasoning abilities. Students should be involved in the examination of value positions implicit in the issue and the construction of logical arguments built upon moral principles. Students should develop their critical and creative thinking abilities through such processes as basing arguments upon fundamental human rights and creating ethical alternatives to practices they consider to be unfair or unsound.
- study of social issues should strengthen students' knowledge of and commitment to fundamental moral principles stemming from a respect for persons. The Canadian Charter of Rights and the United Nations Charter of Rights and Freedoms can be used as sources for establishing these principles.[6]

A model for the examination of social issues which has been used successfully with middle years students is shown in Table 6.1. It is intended as one possible way of structuring student research of a social issue and could be adapted by teachers to suit their own situations. It incorporates four key factors in the examination of social issues:

1. commitment to achieving a perspective on the issue which is factually and ethically grounded.
2. stating the value positions involved in the issues.
3. establishing arguments based upon human rights, human needs or needs of the environment.
4. fact-finding to back arguments.

One other element of social issues research not treated explicitly in this model should also be considered. That is:

5. generation of alternative solutions based on human rights, human needs or environmental needs.

This framework is based on:

1. Developing understanding of human needs.
2. Relating principles of human rights to human needs.
3. Analyzing types of arguments and selecting those which apply.
4. Gathering evidence that establishes arguments to support or refute principles or to establish that the principle is in fact being violated or supported in a specific case.

Table 6.1 can be used as a structure for written reports, oral reports or debates. Following this model, students would begin by identifying a social issue within a range of social issues connected to a unit of study, take a stand upon the issue and state their stand clearly, state the moral arguments used to develop their stand, research and present the evidence to support these arguments. Following the presentation of these reports with further discussion involving students in evaluating the evidence presented (e.g. in terms of its strengths or the credibility of the sources used) also requires students to use strong sense critical thinking abilities.

Summary

The development of this C.E.L. helps students to understand themselves and to have empathy for others. In summary, the development of Personal and Social Values and Skills requires that:

- **educators understand, articulate and model the fundamental values which are foundational to social life and a democratic system of government;**
- **teachers help students to acquire rational processes for examining the value claims and moral dilemmas associated with social issues;**
- **materials and activities in the various subject areas be examined for bias and their potential to create balanced and accurate understandings of the lives and potentialities of both sexes and all cultural groups;**
- **all be valued as persons and treated with dignity and respect.**

6. A teacher's manual and activity guide for studying the *Canadian Charter of Rights and Freedoms*, useful for teachers of middle and secondary students, is available. See our Practical Resources for more information.

Table 6.1

Arguments Relating to Social Issues[7]

A. **Types of Arguments:**

1. Leads to good consequences
   Leads to bad consequences
2. Causes bad consequences
   Causes good consequences

B. **Types of Consequences**

1. Environment harmed
   Environment improved
2. Hazardous to health
   Improves health
3. Violates human rights
   Supports human rights
4. Violates the criminal code
   Supports the criminal code
5. Increases knowledge
   Decreases knowledge
6. Economy: arguments relating to amount spent or needed in proportion to other possible uses for the money

C. **Types of Evidence or Proof**

1. Historical events
2. Statistics
3. Factual knowledge from reference books
4. Opinions of experts
5. Experiments, surveys and other tools of research
6. Personal experiences and accounts of others
7. Your own experiences/feelings/conscience

7. From Klenz (1987), *Creative and Critical Thinking*, p. 75.

Chapter VII: Independent Learning[1]

Independent Learning focuses on creation of the opportunities and experiences necessary for students to become capable, self-reliant, self-motivated and life-long learners. What is desired are students who value learning as an empowering activity of great personal and social worth. All of the other C.E.L.s contribute to the goal of developing independent learners.

Definition

> "Independent Learning is that learning in which the learner, in conjunction with relevant others, can make the decisions necessary to meet the learner's own learning needs." (Kesten, 1987, p. 3)

In this process, independent learners develop the values, attitudes, knowledge and skills needed to make responsible decisions and take actions dealing with their own learning. Independent learning is fostered by creating the opportunities and experiences which encourage student motivation, curiosity, self-confidence, self-reliance and positive self-concept; it is based on student understanding of their own interests and a valuing of learning for its own sake.

Independent learning is part of an ongoing, life-long process of education that stimulates greater thoughtfulness and reflection and promotes the continuing growth of students' capabilities and powers. More than the rote learning of facts and skills, this approach to learning encourages students to make meaning for themselves, based on their understanding of why and how new knowledge is related to their own experiences, interests and needs.

Independent learning is a direction for the process of education, not an absolute standard; this process takes different forms for different students and it varies according to subject matter and students' interests and abilities in the subjects. Independent learning involves the teacher and learner in an interactive process that encourages students' intellectual development and their capacity for independent and reflective judgement.

Independent learning is fostered by a school environment which is sensitive, flexible, democratic and responsive to the needs of students. This encourages a strong sense of purpose and motivation on the part of students. Independent learning makes full use of the resources of the school and the community and fosters the development of independent learners in every grade and in every subject.

The development of Independent Learning - from rationale to processes to goals - is outlined in Figures 7.1 and 7.2.

Rationale

Independent learning addresses the needs of individual learners for independence and active participation in their own learning, both in school and in the larger society. This approach to learning is an important part of core curriculum:

> "It is essential for schools to reduce students' dependence on schools and teachers for their learning and increase students' capability to set and meet their own learning goals." (Core Curriculum Advisory Committee, 1986, p. 13)

Since learning extends beyond the school context, learners require independence as a life skill, to assist them in preparing for new situations and experiences. Independent Learning can assist students in acquiring the knowledge, abilities, skills, values and motivation that enable them to analyze learning situations and develop appropriate strategies for action.

Independent learning requires that people take responsibility for their own learning. Individual responsibility stems from the belief that learning can be affected by effort, and this belief is the critical factor which leads to individuals' perseverance in the face of obstacles. Teachers can help students take responsibility for their learning by providing opportunities and strategies for learning independently and by encouraging them to initiate and actively participate in their own learning.

Students need to explore issues that have meaning and relevance for them. Individual students bring different perspectives and experiences to learning situations, and in the final analysis, it is the learner who achieves learning and creates meaning from any new material or experience. A sense of social responsibility will be fostered by teaching which supports the examination of new knowledge in terms of its relevance and meaning for students in particular and human purposes in general.

1. The work of Cyril Kesten (*Independent Learning*, Saskatchewan Education, 1987) formed an important foundation in the development of this chapter.

Figure 7.1

Independent Learning Flow Chart

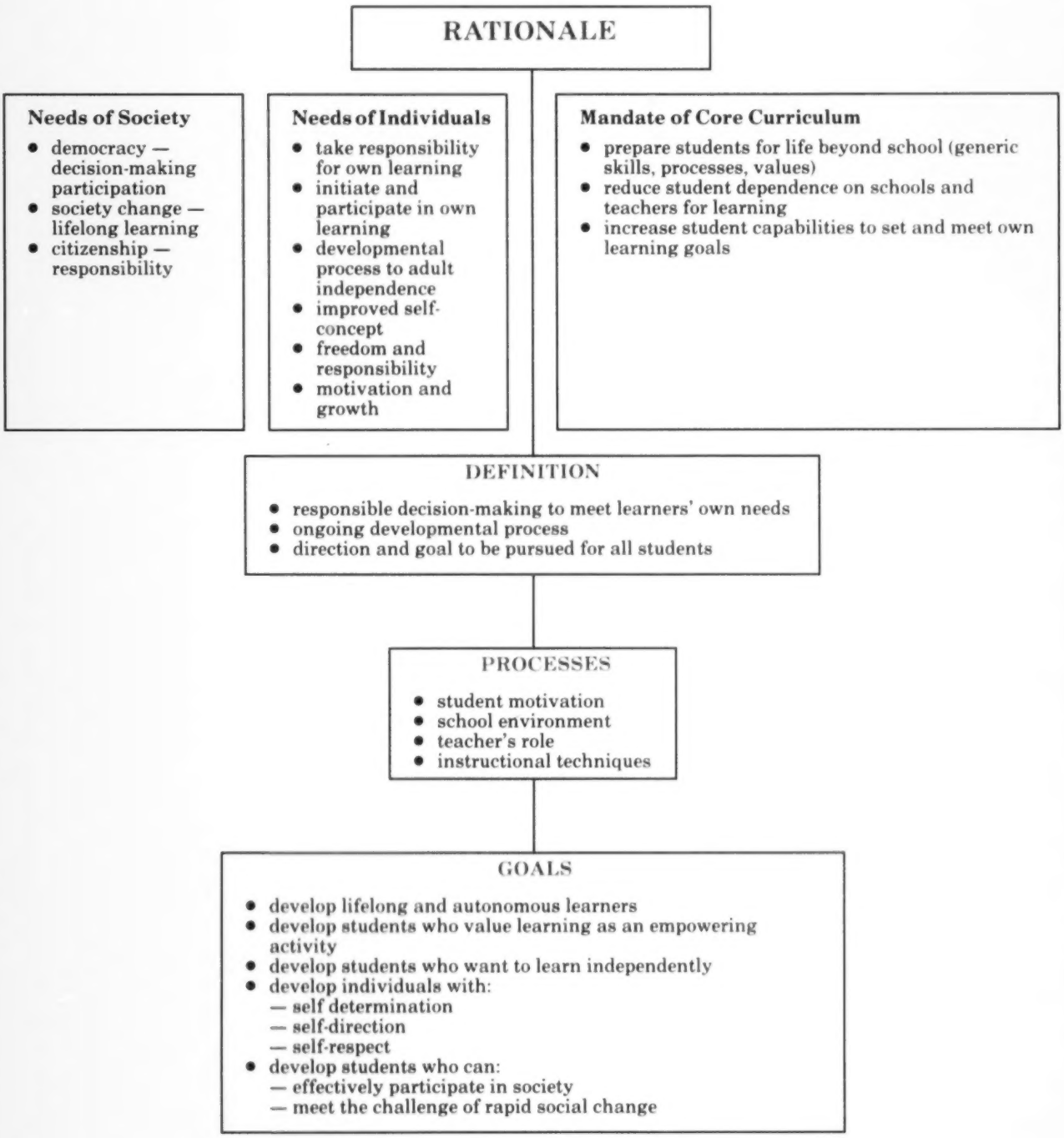
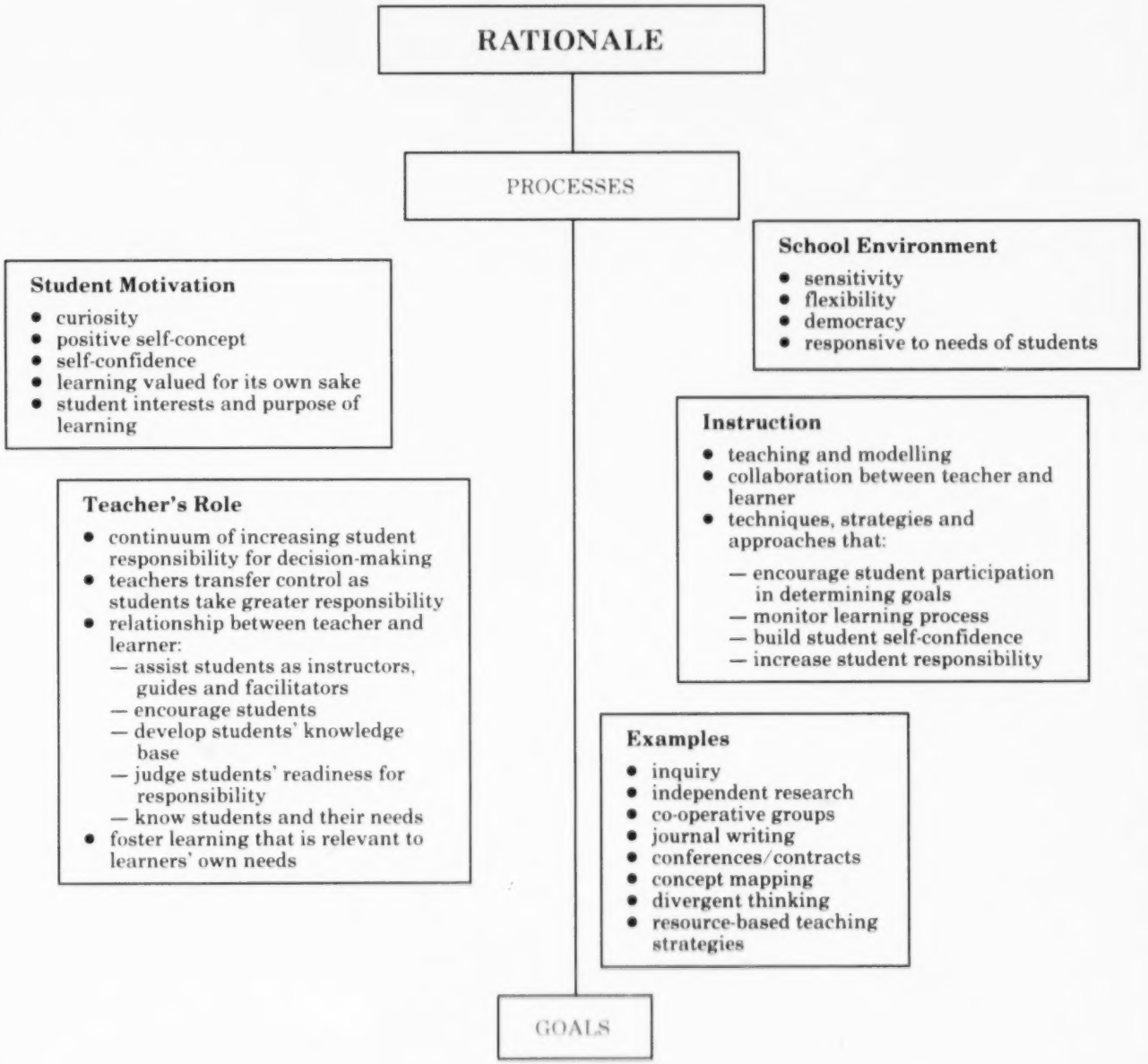

RATIONALE
Needs of Society
• democracy — decision-making participation
• society change — lifelong learning
• citizenship — responsibility
Needs of Individuals
• take responsibility for own learning
• initiate and participate in own learning
• developmental process to adult independence
• improved self-concept
• freedom and responsibility
• motivation and growth
Mandate of Core Curriculum
• prepare students for life beyond school (generic skills, processes, values)
• reduce student dependence on schools and teachers for learning
• increase student capabilities to set and meet own learning goals
DEFINITION
• responsible decision-making to meet learners' own needs
• ongoing developmental process
• direction and goal to be pursued for all students
PROCESSES
• student motivation
• school environment
• teacher's role
• instructional techniques
GOALS
• develop lifelong and autonomous learners
• develop students who value learning as an empowering activity
• develop students who want to learn independently
• develop individuals with:
— self determination
— self-direction
— self-respect
• develop students who can:
— effectively participate in society
— meet the challenge of rapid social change

Figure 7.2

Processes of Independent Learning


RATIONALE
PROCESSES
Student Motivation
• curiosity
• positive self-concept
• self-confidence
• learning valued for its own sake
• student interests and purpose of learning
School Environment
• sensitivity
• flexibility
• democracy
• responsive to needs of students
Instruction
• teaching and modelling
• collaboration between teacher and learner
• techniques, strategies and approaches that:
— encourage student participation in determining goals
— monitor learning process
— build student self-confidence
— increase student responsibility
Teacher's Role
• continuum of increasing student responsibility for decision-making
• teachers transfer control as students take greater responsibility
• relationship between teacher and learner:
— assist students as instructors, guides and facilitators
— encourage students
— develop students' knowledge base
— judge students' readiness for responsibility
— know students and their needs
• foster learning that is relevant to learners' own needs
Examples
• inquiry
• independent research
• co-operative groups
• journal writing
• conferences/contracts
• concept mapping
• divergent thinking
• resource-based teaching strategies
GOALS

An important motivating factor in independent learning is the encouragement of students' own interests and their desire to learn. Students will be motivated to learn if the learning activity is meaningful, and if the knowledge is useful and provides a means of achieving a desired goal. Such learning activities provide a stimulus to reflective inquiry and continuing intellectual development. In contrast, learning activities in which the student has no interest lead to increasing dependence on external motivation and extrinsic rewards. This approach to teaching has the effect of diminishing student initiative, rather than encouraging student participation in learning for its own sake.

Students will move towards independence in varying degrees, depending on factors such as age, skill level and ability in a particular subject. It is important to establish the conditions for enlarging student learning in all its variety, thereby encouraging the growth and development of all students towards greater responsibility for their own learning.

Independent learning cannot be achieved in isolation. Learning is an interactive process among students and between teacher and students. Students engage in learning activities as individuals who are interdependent with other individuals in the classroom and in the wider society.

Independent learning has implications for responsible decision making, as individuals are expected to analyze problems, reflect, make decisions and take purposeful actions. To take responsibility for their lives in times of rapid social change, students need to learn on a life-long basis. As most aspects of our daily lives are likely to undergo profound changes, independent learning will enable individuals to respond to the changing demands of work, family and society. For example, changes in work life will require retraining, job change and life-long learning, and technological

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change will demand the values, attitudes and skills associated with independent learning.

As is the case with Critical and Creative Thinking, Independent Learning is an important foundation for maintaining democracy and promoting social justice. Citizens are called upon to independently assess problems, make rational decisions and take actions - not based on what others decide is best for them, but based on an assessment of their own interests and the interests of others in society. As guardians of the future, today's youth require the independent learning abilities that will empower them to act in accordance with the principle of social justice and for the survival of our planet.

Finally, it is through Independent Learning that all the other Common Essential Learnings become an integrated whole. Independent Learning is a vehicle for consolidating the understandings developed through all of the Common Essential Learnings.

In summary, Independent Learning:

- **is based on meaningful learning activities;**
- **enables individual learners to take responsibility for their own learning;**
- **is essential for life-long motivation and growth;**
- **prepares students for their role as responsible citizens in a changing society;**
- **is a tool for the achievement of all the Common Essential Learnings.**

The Teacher's Role

Three aspects of the teacher's role in fostering Independent Learning are: the learning environment created by the teacher; the relationship established between teacher and learner; and the teaching and modelling of skills needed for independent learning.

Learning environment

Children enter the formal education process as intuitive independent learners. It is important to create a learning environment which furthers this process of independence, and enables students to consciously accept responsibility for and make

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decisions about their own learning. The teacher plays an important role in providing a **supportive environment** that encourages students' motivation, self-confidence, curiosity and desire to learn. Independent learning will be fostered by a climate that is sensitive, flexible and responsive to the learners' needs.

The atmosphere, environment and structure of the school itself must support independent learning, with teachers, principals and others in the school modelling independent learning behaviors. The process of education creates the context within which students can progress towards greater responsibility for their own learning.

Working with teacher-librarians in the library resource centre program will also further encourage student inquiry. Resource-based learning will enable students to access resources, and will involve them in a process of active learning in the school and community. Strong library programs can offer students guidance, support and freedom as they increasingly take responsibility for their own learning.

In a school system based to a great extent upon competition and grades, it is particularly important to **encourage students' intrinsic interest** in learning - learning for its own sake, not as a means to an end. **Independent learning strategies that address the interests and concerns of students, make the curriculum content relevant to students' needs and demonstrate the purpose of learning will contribute to the development of autonomous learners.**

Relationship between teacher and student

The relationship between teacher and learner should foster **increasing learner responsibility.** As students grow in maturity and understanding, they are able to take on greater responsibility for their own learning. As this happens, teachers need to relinquish control of decision making. This transfer of control is best supported by a school environment that is "organized to encourage and support a continued, increasingly mature and comprehensive acceptance of responsibilities for one's own learning" (Kesten, 1987, p. 15).

Teachers assist students in mastering the decision making processes as instructors, guides and facilitators. In this role, teachers not only enable students to **acquire a solid base of knowledge and experience,** but they also help students to discover the personal meaning of this knowledge and experience in terms of their own needs. This process leads to a more meaningful learning experience for students; they are motivated to take greater control over their learning because it is relevant to their needs, both as individuals and as members of society.

As teachers encourage students to take greater responsibility for decision making, they must also **judge students' readiness** for such responsibility. Such judgements are based on the learner's age, maturity, ability and knowledge, and can only be made by teachers who know their students well.

As in all Common Essential Learnings, teachers' **instructional techniques** will be an important basis for implementation of Independent Learning. The attitudes, skills and knowledge of independent learning will be fostered in students, in large part, through the ways in which teachers organize their classrooms and instruct their students.

It is important that teachers utilize instructional techniques, strategies and approaches based on collaboration between learner and teacher. This will encourage student participation, both in determining goals and in monitoring the learning process. Also desirable are teaching approaches that foster student self-confidence and empower students to take responsibility for their own learning.

Teaching and modelling skills

An important aspect of the teacher's role is the **teaching and modelling of skills** needed for independent learning. Consistent with the discussion of the other C.E.L.s, it is important to note that such skills should not be taught in isolation, but rather developed **through** school subject matter. Five principles, adapted from Herber and Herber (1987), provide an outline of how teachers can incorporate skill teaching and create a learning environment which frees their students to become independent life-long learners.

1. Modelling and practicing learning skills:

Independence in the performance of a task is the logical extension of having learned and practiced a task. Students are taught activities which facilitate the transition to independence through modelling, demonstration and direct instruction of learning skills. These are followed by practice opportunities provided by the teacher, who monitors students' progress towards their goals of independent decision making. As part of this process, it is important to share with students what is being done and **why** an activity is useful. The goal is that learners will eventually make their own

decisions, connect what they already know with what they are learning, make judgements and inferences, apply new ideas and derive pleasure from learning.

The following example outlines this learning process:

Students might undertake a class project on time management in conjunction with doing an assignment. The teacher and students would do the assignment together. As the teacher models the actions involved in time management through thinking aloud, the students are learning ways to manage time during this assignment as well as why this is important. The teacher then models and prompts student action in doing another assignment and attending to the time management needed. This modelling is repeated until the student can do the activity without cues from the teacher, and gradually takes over the actions. As an important part of this process, students are reminded often that there are other solutions to a problem such as time management; they are encouraged to seek the solutions that work best for them. Discussion of students' personal adaptations should follow completion of the assignments.

The teacher-librarian has an important role to play in developing independent learning skills, such as narrowing a topic or identifying sources. See pp. 6-7 of *Learning Resource Centres in Saskatchewan* (Saskatchewan Education, 1988) for a more complete description of the place of the school resource centre in teaching learning skills.

2. Transfer of responsibility from teacher to learner:

Independence is developed by design, not chance. Four steps involved in the skill aspect of independent learning are: show students how; provide practice; have students structure activities; finally, have them use the activities independently.

The pace of this sequence is dependent upon the age and background of the student, the level of the task to be done and the attitudes of both teacher and student. The transfer of decision making responsibility from teacher to student is a key part of the teacher's role in fostering independent learning; the transfer needs to be accomplished without either over- or under-controlling the process. This shift is enhanced by a teachers' positive attitude to independent learning, as well as a good knowledge of the needs, interests and abilities of individual students. This transfer of control is crucial; it leads to students discovering how their efforts can affect their learning. Students then experience control of the learning task, and from this control they acquire motivation to continue learning.

3. Knowledge and understanding of students:

Independence is a relative state. Independent learning is a cyclical process, whereby students learn a skill at one level, then use the skill to learn other skills or content, repeating the cycle many times over. This process is related to the developmental level of the student, the requirements of the material and the effective transition from learning a skill to using the skill to learn.

As part of this independent learning process, it is important that teachers know their students well. Teachers need to observe and reflect upon students' learning processes. This role is a proactive one, since in order to help the students succeed as independent learners, the teacher needs to anticipate difficulties and offer support at crucial intervals.

Teachers need to develop a good understanding of their students' strengths and weaknesses - socially, emotionally, intellectually and physically - their exceptionalities, their health, their cultural backgrounds. Students become motivated when they believe that they have the ability to control their own learning. This motivation is enhanced by learning which builds on students' own interests; basing learning experiences on students' needs and interests helps develop enthusiastic learners. **For independent learning to proceed, student choice must become a regular part of the classroom environment, including the structuring of assignments, topics, group processes and timelines.**

4. Collaborative instructional techniques:

Independent learning is not carried out in isolation; it includes co-operative, small group and whole class learning. Independent learners select from a variety of settings, resources and styles that meet their needs and interests. The teacher's role is to facilitate learning in a variety of ways which are age appropriate, subject appropriate, related to available resources and related to students' needs for a balance between structured experience and independence. Instructional approaches which facilitate independent learning include the following:

— divergent thinking
— concept mapping
— journal writing
— learning centres
— inquiry process
— independent research
— student-teacher conferences

Teachers can also vary the setting, topic, assignment, time, depth and group processes. All variety and choices should include provisions for learning study skills, as well as student input into evaluation.

5. Support and encouragement to students:

Becoming independent is an ongoing process which takes time, patience and support. To be life-long learners, students are ever in the process of becoming independent. It is the responsibility of the educator to foster this developmental process of learning.

The teacher's role is to be a patient facilitator, showing students how to learn independently, encouraging them, providing feedback and supporting their efforts. These are all crucial factors in providing a learning environment which fosters independent learning and which motivates students to pursue independent learning skills.

Summary

In summary, teachers can foster Independent Learning by:

- **using a variety of ways to gain understanding of their students' abilities, needs and interests;**
- **making education relevant to students' needs and interests;**
- **teaching and modelling independent learning skills;**
- **providing students with choice in assignments and topics within a range of choices;**
- **increasing students' responsibility for decision making in the independent learning process;**
- **utilizing collaborative instructional techniques.**

In this way, teachers can create a supportive classroom environment and motivate students to learn. These approaches are based on teachers' understanding of and support for the goals of Independent Learning. Through this process, students will develop into individuals with self-respect, self-direction and self-determination, and be better able to effectively participate in society and interact reflectively with rapid social change.

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Appendix A Practical Resources for Teachers

The following resources are **suggestions only**. It is hoped that the material listed here will be useful in facilitating the incorporation of the C.E.L.s into existing curricula. **It should be noted that some of the suggested works (such as those which deal with contemporary issues and values) may not be appropriate in certain situations; activities may need to be selected with some sensitivity to the needs of individual communities.** Other works which contain individual activities or strategies are intended to be integrated into lessons which introduce meaningful content, and not to be used as separate ends in themselves. Those works which relate to specific subject areas may also provide strategies which can be applied throughout the Required Areas of Study.

The list is not meant to be definitive or prescriptive, but rather **to be adapted** by classroom teachers. It is anticipated that through individual use, the list will be continually updated as teachers note which works are personally useful or not useful and as they add or delete titles. The resources are listed under the headings of the individual C.E.L.s.

Communication

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Buchanan, E. (1980). *For the Love of Reading*. Richmond Hill, Ont.: Scholastic-Tab Publications Ltd.

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Numeracy

Arithmetic Teacher. National Council of Teachers of Mathematics. (NCTM).

This journal features a section on teaching ideas for estimation and mental computation (elementary and middle grades).

Computational Estimation. Dale Seymour Publishing Company.

— available from Spectrum
— 3 books for Grades 6, 7 and 8
— 15 lessons in each

Developing Skills in Estimation. Dale Seymour Publishing Company.

— activity worksheets
— Book A for grades 6-7
— Book B for grades 8-9

GUESS: Guide to Using Estimation Skills and Strategies. Dale Seymour Publishing Company.

— teaching cards and practice cards
— 200 cards in each box
— Box I and Box II for middle grades and up

Hope, J., Reys, B. and Reys, R. (1987). *Mental Math in the Middle Grades*. Dale Seymour Publishing Company.

— 36 lessons
— blackline masters
— practice exercises, tests and teaching suggestion
— also available: *Mental Math in the Primary Grades, Mental Math for Grades 6-8*

Huff, D. (1954). *How to Lie With Statistics*. New York: W. W. Norton and Company.

— provides many examples to illustrate use and misuse of statistics

Math Works. (1985). Agency for Instructional Technology, Box A, Bloomington, Indiana 47402.

— a series of twenty-eight 15 minute video programs
— emphasizes reasoning and solving skills for 5th graders
— also available: Solve It for 6th graders (eighteen 15-minute programs)

Schoen, H. and Zweng, M., eds. (1986). *Estimation and Mental Computation: 1986 Yearbook*. NCTM.

— a collection of articles related to teaching estimation and mental calculation

Shulte, A. and Smart, J., eds. (1981). *Teaching Statistics and Probability: 1981 Yearbook*. NCTM.

— a collection of articles related to teaching statistics and probability

Thinkabout. (1979). Agency for Instructional Television.

— available through Educational Resources Distribution Branch and aired on school telecasts
— a series of sixty 15-minute video programs
— features skills essential for learning (including solving problems) for 5th and 6th graders

Critical and Creative Thinking

Frost, M. (1987). *Speech: Principles and Practice*. Glenview, Illinois: Scott, Foresman and Company.

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Acid Rain: The Silent Crisis. Public Interest Group, 427 Bloor Street West, Toronto, Ontario, M5S 1X7.

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____ (1984). Television.

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Future of Synthetic Materials: The Petroleum Connection. (1980). Washington, D.C.: Worldwatch Institute.

Holman, J. (Project Organizer) (1986). SATIS. (Science and Technology in Society).
— interactive units relating science to important social or technological aspects
— for information write to:

Office of High School Chemistry
American Chemical Society
1155 Sixteenth Street N.W.
Washington, D.C. 20036

Parisi, L. (ed.). (1986). *Creative Role-Playing Exercises in Science and Technology*. Boulder, Col.: Social Science Education Consortium.

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